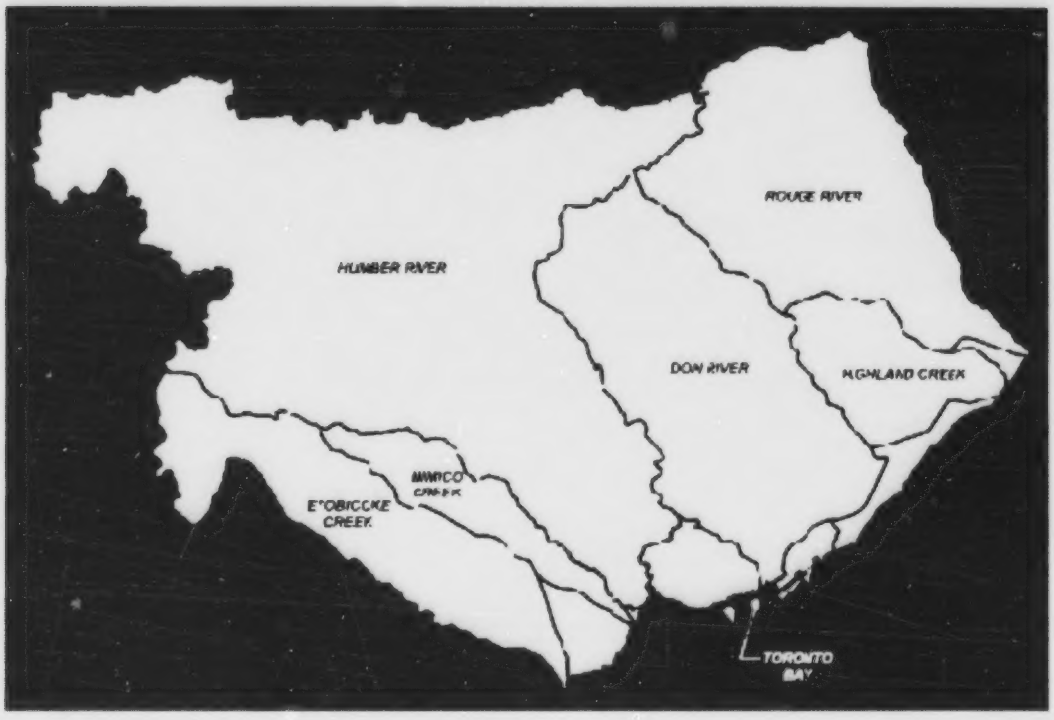
TORONTO AND REGION REMEDIAL ACTION PLAN



ASSESSMENT OF SIX TRIBUTARY DISCHARGES TO THE TORONTO AREA WATERFRONT VOLUME 1: PROJECT SYNOPSIS AND SELECTED RESULTS

Remedial Action Plan
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ASSESSMENT OF SIX TRIBUTARY DISCHARGES TO THE TORONTO AREA WATERFRONT

VOLUME 1:

PROJECT SYNOPSIS AND SELECTED RESULTS

Report prepared for
The Toronto and Region Remedial Action Plan

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Foreword

This report completes a series of technical documents prepared on behalf of the Toronto RAP which have also covered assessment of wet and dry weather discharges from sewers and sewage treatment plants. Although the data in this report have been released previously in various forms over the past three years to partners in the Toronto RAP, until now they have not been summarized and submitted for formal publication and distribution to a wider audience.

This summary document containing selected results has been prepared for widespread distribution. A companion document entitled: *Assessment of Six Tributary Discharges To the Toronto Area Waterfront Volume 2: Technical Appendix and Data Listing* is available for those readers who wish to have access to the entire data set.

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1.0 INTRODUCTION

1.1 Background

The Toronto Waterfront has been designated as one of 16 remaining areas of concern in Ontario by the International Joint Commission (IJC). The IJC has recommended the development of a Remedial Action Plan (RAP) for the restoration of the waterfront to its desired uses. The RAP is to include a description of the causes of pollution and to propose measures for remediation. In developing the Toronto and Region RAP, the RAP Team has recognized a deficiency in contaminant and flow data for various discharges to the waterfront.

The Toronto Waterfront, extending west from Etobicoke Creek and east to the Rouge River, receives flow from numerous sources including:

(a) effluent from three water pollution control plants (WPCP),

(b) backwash water from three water filtration plants (FP),

(c) over 100 combined and storm sewer outfalls (CSO and SS), and

(d) six watersheds (Humber, Don and Rouge Rivers, and Etobicoke, Mimico and Highland Creeks).

A number of studies have been initiated in support of the RAP development to investigate contaminant discharges from these sources. Results from the WPCP, FP, and CSO/SS studies have already been documented (Snodgrass and D'Andrea 1993, Paul Theil Associates Limited and Beak Consultants Limited 1995, Maunder and Whyte 1995, and Aquafor Beech Limited 1997). This report documents results of a study initiated in late 1990 to evaluate the chemical composition and contaminant mass discharges of the six watersheds.

1.2 Study Objectives

The primary objectives of the study were to:

(1) Identify the chemical constituents present in each tributary (including conventional water quality parameters, bacteria, nutrients, heavy metals and trace organic compounds),

(2) Estimate mean contaminant concentrations under dry and wet weather conditions,

(3) Compare contaminant concentrations between watercourses,

(4) Estimate the seasonal and annual contaminant mass discharge for each watercourse,

A strong emphasis was placed on the analysis of trace organic compounds which involved

special sample collection and analytical procedures. In addition, non-traditional techniques were used in the analysis of data sets containing data at or below the analytical detection limit.

Results from this study are intended to assist in the development, prioritization and design of remedial options and will form a data base by which the effectiveness of remedial measures can be evaluated once implemented.

1.3 Description of the Watersheds

Table 1.1 provides a summary of drainage area and land use characteristics by watershed. The Oak Ridge Moraine, stretching across the northern boundary of the Toronto and Region RAP, is the divide for watercourses draining to Lake Ontario and those draining to the north. With the exception of Highland Creek, the watersheds, extend across several municipal and regional boundaries. It should be emphasized that while only the most downstream locations were monitored in this study, the cumulative effect of inputs from all upstream sources will be reflected in the data. Watershed drainage areas are presented in Figure 1.1. By drainage area the watersheds ordered in decreasing size are: Humber River, Don River, Rouge River, Etobicoke Creek, Highland Creek and Mimico Creek.

From Table 1.1, the watersheds can be ordered by decreasing levels of urbanization as follows: Highland Creek, Mimico Creek, Don River, Etobicoke Creek, Humber River and Rouge River. Generally, the land use activity in these watercourses can be characterized by predominantly highly developed urban areas in the lower reaches, and an urbanizing fringe extending north of metropolitan Toronto. Further upstream, the evolving rural landscape supports agricultural activity and includes many small towns. In most cases, the river and creek valleys in the lower urbanized reaches are generally open space which interconnect parkland.

TABLE 1.1: WATERSHED LAND USE CHARACTERISTICS (TRCA 1998)

LAND USE	WATERSHED					
	ETOBICOKE CREEK	MIMICO CREEK	HUMBER RIVER	DON RIVER	HIGHLAND CREEK	ROUGE RIVER
Total Area (km^2)	211	77	908	360	102	327
Industrial/Commercial	24%	35%	6%	18%	23%	5%
Institutional	7%	9%	1%	6%	4%	1%
Residential	22%	33%	17%	43%	54%	12%
Open Space	24%	23%	30%	31%	19%	15%
Agricultural	23%	0%	46%	2%	0%	67%

1.4 Description of Contaminant Sources

As previously noted, the watersheds are heavily urbanized and the sources of contaminants to each watershed are diverse. Table 1.2 presents an estimate of the number of storm sewer and combined sewer overflow outfalls which discharge to each of the watercourses. These sewers can be significant sources of contaminants under dry and wet weather conditions. Under dry weather conditions contaminant sources can include: sanitary sewer cross connections, infiltration from the sanitary sewer system, accidental or deliberate spills to road side catch basins, industrial cooling water, and excess surface watering (i.e. lawns, washing on paved surfaces, etc.).

Under wet weather conditions there are numerous contaminant sources to storm sewers and combined sewer overflows. These sources are related to both local land use activities and atmospheric wet and dry deposition (where the contaminants may originate from local or remote emissions). Atmospheric and local land use activity sources typically include:

(a) combustion emissions from industrial activities, incinerators, heating (including residential) and power generation activities, and vehicular traffic;

(b) heavy metal emissions from electrical and chemical industries, smelting, refining, welding and spray coating operations; and

(c) airborne emissions of pesticides in agricultural and residential applications.

(d) chemical (fertilizers and pesticides) applications in urban areas;

(e) vehicular traffic byproducts such as exhaust, brake and tire wear, fuel and engine oil leaks or spills, corrosion, deicing chemicals;

(f) wash off from commercial/industrial storage areas; and

(g) faecal material from wildlife and domestic animals.

Sources of contaminants in combined sewer overflows include all the above-mentioned sources as well as contaminants associated with wastes in the sanitary stream from industrial, commercial and residential discharges.

Other sources of contaminants or water quality degradation in watercourses can include: stream bank erosion, erosion from construction sites, agricultural runoff (fertilizers, pesticides and animal faeces), landfill leachate, and sewage treatment plant effluent.

Contaminant inputs to each of the six Toronto area watersheds under investigation will be influenced by a range of local land use factors and point sources. For example, Etobicoke Creek flows along the western perimeter of Lester B. Pearson International Airport and most of the storm drainage (1,547 ha) from the airport lands is routed to the creek. Mimico Creek flows east of the airport and receives approximately 180 ha of storm drainage from the airport. Effluent

flow from York Region's Kleinburg Water Pollution Control Plant (0.2 MLD) is discharged to the northern portion of the Humber River watershed while the Don River receives effluent flow from the City of Toronto's North Toronto Water Pollution Control Plant (45 MLD) upstream of Pottery Road.

1.5 Study Approach

The study involved the collection of water samples from each watercourse during dry and wet weather, compiling flow data collected by Environment Canada and then compiling statistical summaries of flow, contaminant concentrations and contaminant loadings (mass discharges). Each sample was collected as a 24 hour time composite. Samples were collected from each watercourse for a minimum one year period during a two year monitoring program between 1991 and 1992. Special consideration was given to the sample volume requirements necessary to detect priority trace organic contaminants at low concentrations. Large volume (100 litre) samples were collected in order to achieve reasonably low analytical detection limits for these compounds, while an additional sample volume of about 20 litres was collected for the analysis of other contaminants of interest.

Sampling stations were established as close to the mouth of each watercourse as possible, upstream of lake backwater effects. In all cases, samples were collected by means of an automatic wastewater sampler. The intake line was positioned at approximately mid-depth and as close to the middle of the watercourse as possible. Sampling equipment was installed inside Environment Canada flow gauging stations at the Don River and Etobicoke Creek stations. At all other sampling stations equipment was installed in secure, portable huts.

The parameters analysed in this study included the following major groupings: general chemistry, organochlorine pesticides/PCBs, nutrients, chlorophenols, chlorobenzenes, bacteriology, volatile organics, metals, and polynuclear aromatic hydrocarbons (PAHs).

With the exception of the large volume (100 litre) trace organics analyses of chlorobenzenes, organochlorine pesticides, polynuclear aromatic hydrocarbons (PAHs) and total PCBs, the Ontario Ministry of the Environment, Laboratory Services Branch performed the chemical analysis for all compounds. Analytical methodologies described in MOE (1988) were used in these analyses.

Mann Testing Laboratories performed the chemical analysis of the large volume samples for the above-mentioned trace organic compounds. The analytical procedure involved using a Goulden Extractor for the solvent extraction of the unfiltered sample (liquid-liquid extraction using DCM). The concentration, cleanup and analysis using a dual column/dual electron capture detector followed the methodology described in MOE (1988); except for the analysis of PAH compounds which used a mass spectrometer detector.

Median dry and wet weather concentrations have been computed and presented in this summary document. Probability distribution estimation (PDE) techniques were used to estimate the mean and corresponding confidence interval for the data sets containing "left-censored" data (i.e. results below the limit of detection) for the complete data summary included in the companion document to this report: *Volume 2: Technical Appendix and Data Listing*. These techniques use the probability distribution of the non-censored data (data above the detection limit) to estimate the statistical properties of the entire data set. One of these techniques, the maximum likelihood estimation (MLE) method is widely accepted for the statistical description of left-censored water chemistry data (Cohen 1959, Gilbert 1987, and El-Sharaawi and Dolan 1989), and was one technique used in this study. It provides an estimate of the mean and standard deviation of the data set by using estimates of the statistical properties of the non-censored data. It is recommended for use when up to 80% of the distribution is censored and where there is a minimum of three non-censored values. A more traditional approach such as substituting a fraction (generally 0.5) of the analytical detection limit value for those values which were at or below the detection limit was used when the data characteristics did not permit the application of the PDE techniques. This approach was used to provide only qualitative mean estimates of the data. Confidence intervals were not presented because they are biassed by the substituted data.

Contaminant mass loading estimates were generated for each tributary using the Beale Ratio Estimator technique; a well established approach for the estimation of tributary contaminant mass loadings when continuous flow data and discrete water chemistry data are available (Dolan *et al.* 1981). This method derives the ratio of the mean of measured loads to the mean of their corresponding flow measurements which is then combined with the mean of actual flow to yield an overall loading estimate. The estimate can be improved by partitioning the data set into strata based on flow driven relationships with contaminant concentration. In this study, the Beale Ratio Estimator was used with dry weather ("low") and wet weather ("high") flow strata (except for the Rouge River which used one low flow stratum and two high flow strata) to generate estimates of mass discharges and the associated 95% confidence interval for those cases where the water chemistry sample size was sufficiently large to provide reasonable estimates. For most tributaries this was possible for estimations of annual, and wet and dry weather loadings.

Results presented here should be considered representative of relative loadings among tributaries rather than long-term average conditions since this technique was applied using flow and water chemistry data collected during this study period only. Each tributary was sampled for a period of one year within the overall two year window and extreme conditions such as large storms or lower than average spring flows resulting from below average snow accumulation (as was experienced in 1992) will have influenced the estimates of contaminant mass loadings.

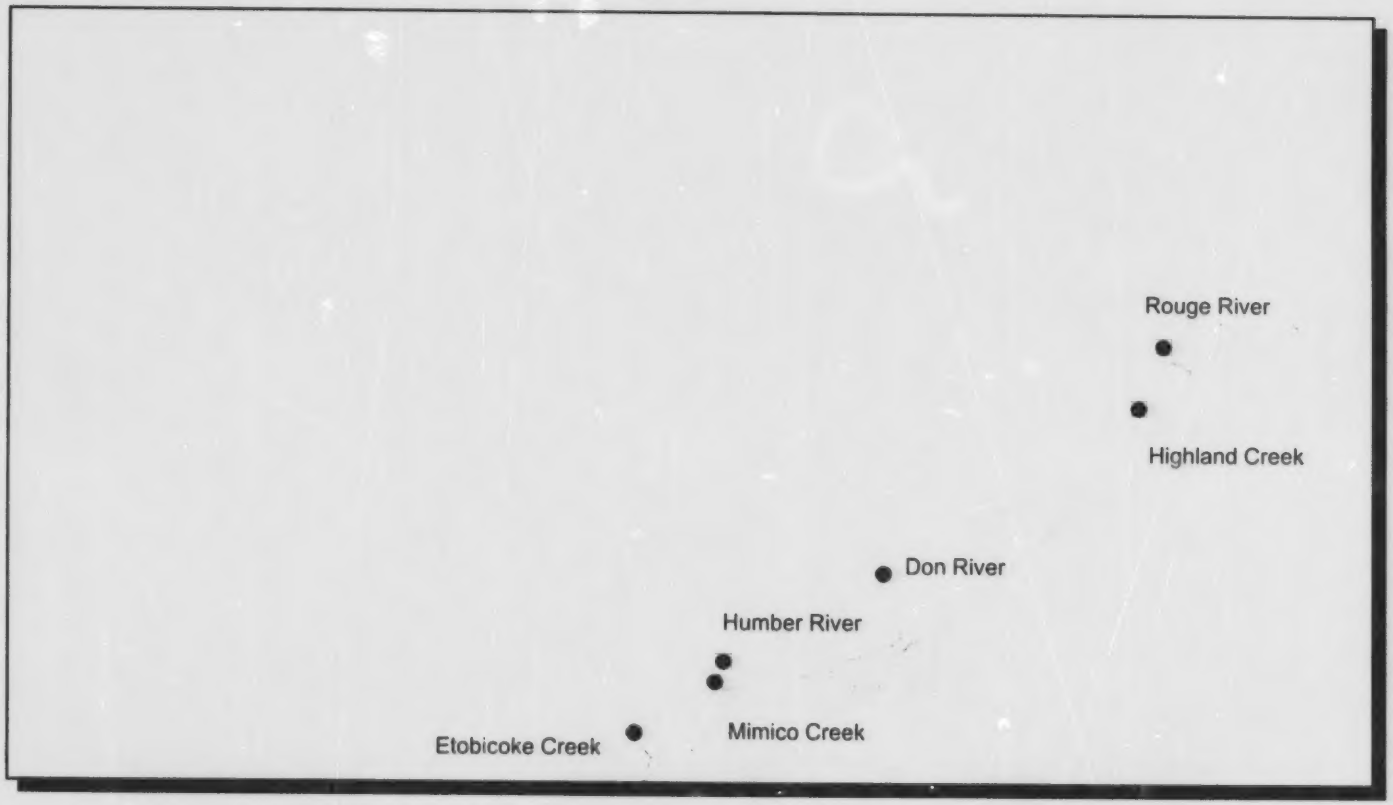

Figure 1.1 Drainage Basin Areas and Sampling Locations

TABLE 1.2: SEWER OUTFALL DISCHARGES WITHIN TORONTO TO EACH WATERSHED (Environment Canada *et al.* 1988)

WATERSHED	NUMBER OF SEWER OUTFALLS		TOTAL
	Storm Sewers	CSOs	
Etobicoke Creek	57	0	57
Mimico Creek	194	0	194
Humber River	619	5	624
Don River	872	30	902
Highland Creek	473	0	473
Rouge River	13	0	13

2.0 RESULTS FOR SELECTED CONTAMINANTS

Complete wet and dry weather water quality results (means, 95% confidence intervals) for all 76 physical parameters, nutrients, bacteria, metals, pesticides, polynuclear aromatic hydrocarbons (PAHs), and volatiles are summarized in *Volume 2: Technical Appendix and Data Listing* for all six tributaries. Volume 2 also contains complete wet weather, dry weather, and annual loading summaries (with estimated error) for all six tributaries.

Of the 76 parameters listed in *Volume 2*, 47 have Provincial Water Quality Objectives (PWQOs) and Table 2.1 provides a complete summary identifying frequencies of detection in excess of PWQOs. The table demonstrates that of the 47 water quality parameters having PWQOs, 22 of them were never detected at concentrations greater than PWQOs in any dry or wet weather samples from these six tributaries.

Results from Table 2.1 can also be used to select a subset of "indicator" parameters from the complete list of 76 physical parameters to illustrate the range of available results. The list in the table has been sorted by average frequency of detection above PWQOs for each parameter and has been used to select the following eight: Suspended Solids (SS; not included in Table 2.1 but a useful surrogate for a wide range of hydrophobic substances such as metals and trace organics), Total Phosphorus (TP), *E. Coli*, Copper (Cu), Lead (Pb), Aldrin/Dieldrin, Phenanthrene, and

Total PCB (PCB). These general indicators were selected as the most frequently detected representatives of pollutant classes (e.g. nutrients, metals, trace organics) having PWQOs (or interim PWQOs) greater than (or equal to) analytical detection limits.

These data have been summarized to provide a comparison of wet and dry weather concentrations with Provincial Water Quality Objectives (PWQOs) across all tributaries along with a comparison of dry weather, wet weather, and annual loadings.

2.1 Detection Frequencies Above PWQOs

Figure 2.1 summarizes detection frequency information for seven of the eight selected parameters (excluding suspended solids which has no PWQO). The general picture which emerges from this cross section of results is that wet weather concentrations of all seven parameters consistently exceed PWQOs. The exceptions were Aldrin/Dieldrin (which ranged from 0%>PWQO at Mimico Creek and the Rouge river to just over 40%>PWQO at the Don River), and PCB (which ranged from less than 10% at Highland Creek and the Rouge River to just over 80% at the Don River). Dry weather observations were more variable depending upon location and parameter. Dry weather observations in excess of PWQOs were greater than 50% for: TP at Mimico Creek and the Don River; E. Coli everywhere except the Don River and Rouge River; Cu and Pb everywhere (except Cu at the Rouge River). Dry weather observations in excess of PWQOs were nil for Aldrin/Dieldrin at all locations, and were less than 10% for PCB at Mimico Creek, Highland Creek, and the Rouge River.

TABLE 2.1: FREQUENCY OF SAMPLES EXCEEDING PROVINCIAL WATER QUALITY OBJECTIVES

PARAMETER (* denotes *interim* PWQO)	PWQO (ug/L)	ETOBICOKE CREEK		MIMICO CREEK		HUMBER RIVER		DON RIVER		HIGHLAND CREEK		ROUGE RIVER	
		DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET
*Fluoranthene**	0.0008	78%	100%	88%	92%	100%	95%	78%	100%	75%	100%	80%	87%
E. Coli (count/100mL)	100.00	90%	100%	100%	100%	100%	100%	32%	89%	91%	100%	44%	90%
*Aluminum**	75.00	62%	100%	72%	100%	81%	100%	86%	100%	42%	93%	91%	100%
*Lead**	5.00	86%	94%	78%	93%	90%	88%	86%	90%	58%	100%	64%	88%
Copper	5.00	81%	94%	78%	93%	81%	85%	86%	100%	50%	100%	18%	81%
*Chrysene**	0.0001	50%	93%	81%	100%	84%	95%	61%	100%	25%	77%	50%	60%
*Total phosphorus**	30.00	38%	94%	94%	100%	50%	88%	100%	100%	17%	80%	18%	81%
Iron	300.00	29%	94%	39%	93%	52%	92%	100%	100%	25%	80%	27%	88%
*Cadmium**	0.50	67%	75%	61%	67%	67%	62%	64%	55%	25%	67%	36%	38%
*Benzo[a]anthracene**	0.0004	17%	79%	56%	100%	53%	91%	13%	100%	0%	69%	30%	53%
*Benzo[g,h,i]perylene**	0.00002	28%	79%	44%	92%	26%	82%	26%	100%	0%	77%	0%	53%
Silver	0.10	43%	44%	61%	40%	52%	46%	64%	52%	42%	13%	55%	31%
*Zinc**	20.00	24%	69%	33%	87%	24%	69%	27%	90%	0%	60%	0%	19%
PCB	0.001	38%	63%	6%	67%	32%	44%	13%	84%	0%	8%	9%	6%
*Phenanthrene **	0.030	6%	57%	25%	69%	5%	36%	13%	61%	0%	46%	0%	47%
*Perylene**	0.00007	6%	14%	19%	77%	5%	41%	0%	61%	0%	46%	0%	33%
*Anthracene**	0.0008	6%	36%	25%	62%	5%	45%	9%	67%	0%	23%	0%	7%
*Dibenzo[a,h]anthracene**	0.002	6%	14%	6%	69%	5%	27%	0%	44%	0%	23%	0%	13%
Aldrin/Dieldrin	0.001	0%	13%	0%	0%	0%	8%	0%	42%	0%	15%	0%	0%
*Benzo[a]pyrene**	0.210	0%	21%	0%	15%	0%	14%	0%	11%	0%	0%	0%	0%
DDT+	0.003	0%	13%	0%	0%	0%	0%	0%	37%	0%	0%	0%	0%
Nickel	25.00	5%	13%	0%	0%	0%	8%	0%	5%	0%	0%	0%	6%
*Arsenic**	5.00	0%	0%	0%	0%	5%	0%	0%	5%	0%	13%	0%	6%
*Fluorene**	0.200	0%	0%	6%	8%	0%	0%	0%	0%	0%	0%	0%	0%
Lindane	0.010	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chlordane	0.060	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Methoxychlor (DMDT)	0.040	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*Mercury**	0.20	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Heptachlor+Heptachlor epoxide	0.001	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pentachlorophenol	0.500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pentachlorobenzene	0.030	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,3-Trichlorobenzene	0.900	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,4-Trichlorobenzene	0.500	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,3,5-Trichlorobenzene	0.650	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,4,5-Tetrachlorobenzene	0.150	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Napthalene	7.000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1-Methylnapthalene	2.000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2-Methylnapthalene	2.000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Beryllium	1100.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chromium	100.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Selenium	100.00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*Bromoform**	60.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*Tetrachloroethylene**	50.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*Toluene**	0.8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*1,1,1-Trichloroethane**	10.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*Trichloroethylene**	20.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
*p-Xylene**	30.0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

2.2 Contaminant Concentration Characteristics

Median contaminant concentrations are compared with Provincial Water Quality Objectives (PWQOs) as a means of evaluating the potential severity of water quality conditions. Figure 2.2 summarizes concentration data for the eight selected parameters described above.

Median Cu and Pb concentrations exceeded PWQOs under both wet and dry conditions at all locations, as did median wet weather contaminant concentrations of TP and *E. Coli*. Median concentrations of PCBs exceeded the PWQO of 1.0 ng/L under wet weather conditions at three of the tributaries only (Etobicoke Creek, Mimico Creek, and the Don River) as did median wet weather concentrations of Phenanthrene . It should be noted that final PWQOs are not yet available for many of the other trace organics detected in this study and consequently their significance cannot be directly evaluated in this way. Many of these substances have been identified as high priority "Persistent Organic Pollutants" by MOE, Environment Canada, and the International Joint Commission due to their bioaccumulative and toxic properties, and have been targeted for "zero discharge".

Median wet weather contaminant concentrations generally exceeded dry weather concentrations by as much as an order-of-magnitude for suspended solids, TP, *E. Coli*, Phenanthrene and PCBs (see Figure 2.2). The pattern of elevated concentrations of these contaminants under wet weather conditions is not surprising given the well documented relationship between flow and suspended solids concentrations, and hence contaminants typically associated with particulate matter. Figure 2.2 demonstrates that the Don River tended to have the greatest wet weather median concentrations of all eight parameters (although Etobicoke Creek had similar concentrations of Cu and Pb). With the exception of wet weather suspended solids (which were fairly uniform at all tributaries other than the Don), the Rouge River tended to have the lowest median contaminant concentrations (although the Humber River had similar concentrations of Pb and TP). This variable pattern reflects the association between differing land use patterns and associated contaminant sources across these six tributaries and their effect on typical concentrations throughout the year.

2.3 Contaminant Loadings

Total wet weather, dry weather, and annual loading estimates for the eight selected contaminants are presented in Figure 2.3.1 as a means of demonstrating the relative contributions of the six tributaries to the Toronto Waterfront. Since these calculations are dominated by flow, a summary of loadings data is presented in Figure 2.3.2 which normalizes annual loadings for drainage basin area as a more diagnostic means of identifying local land use practices or sources which could be targeted for pollution prevention or abatement initiatives.

The largest tributary, the Humber River, contributed the largest annual loadings of suspended solids, TP, Cu, Pb, and PCB. Exceptions to the general pattern of drainage basin size and total contaminant loadings were observed for the Don River which contributed the greatest loadings of *E. Coli* and Aldrin/Dieldrin, and Etobicoke Creek which was the largest contributor of the PAH Phenanthrene.

Figure 2.3.2 diminishes the dominance of flow in comparisons of loadings between tributaries and highlights several anomalies by providing a comparison of relative loadings per unit of drainage basin area. This picture differs considerably from the total loading comparison. Patterns which emerge from this analysis include the following:

(a) Two of the most rural watersheds (the Humber River and the Rouge River) contributed the greatest quantity of suspended solids and TP per unit area while two of the most urban watersheds (Mimico Creek and the Don River) contributed the least;

(b) The greatest unit area contribution of bacteria came from the Don River which is most probably a reflection of the sewer infrastructure (i.e. a combined sewer overflow system) and the limited storm water storage capacity of the watershed (due to its poorly drained soils and its high proportion of paved surfaces and artificial drainage channels);

(c) The Don River and Highland Creek, which have similar land use characteristics (i.e. predominantly residential and industrial/commercial), stand out with respect to their unit area contribution of Aldrin/dieldrin (which may be a reflection of historical use as a soil insecticide to control termites);

(d) There was an enhanced unit area contribution of the PAH Phenanthrene (a fuel combustion product) from Etobicoke Creek and Mimico Creek (particularly Etobicoke Creek) which receive significant drainage from Pearson International airport and which have a relatively large proportion of their watersheds occupied by multi-lane roads; and

(e) Highland Creek and the Rouge River had extremely small unit area contributions of PCB relative to other tributaries.

3.0 CONCLUSIONS AND RECOMMENDATIONS

These water quality results were obtained as near to the lake as possible, and hence cannot by themselves be used identify specific pollution sources. Nonetheless, they can be used to confirm the relationship between varying land use patterns and pollution sources on tributary water quality across the Toronto waterfront. This information can be used to guide future monitoring for improved source identification, as well as to confirm support for a general range of "good housekeeping" preventative measures associated with infrastructure maintenance and construction.

General conclusions and recommendations are as follows:

(1) Although Lake Ontario monitoring indicates the effect of tributary water quality is relatively localized, generally poor water quality conditions were evident at these six tributaries with median concentrations of a wide range of contaminants failing to meet PWQOs, particularly under wet weather conditions;

(2) A significant relationship exists between wet weather events and increased concentrations and loadings of a wide spectrum of contaminants (i.e. there is little evidence of a dilution effect attributable to rainwater);

(3) There is indirect evidence of local sources of persistent, bioaccumulative substances such as Aldrin/dieldrin and PCB;

(4) The well documented relationship between wet weather (high flow) events and increased concentrations and loadings of a wide spectrum of contaminants suggests that stormwater management remains the single most important means of improving water quality in Toronto tributaries as well as the harbour and localized areas of Lake Ontario;

(5) Storm water management measures will need to be accompanied by source identification investigations for high priority contaminants since although reduction of storm water flows reduces the transport of contaminants into tributaries and the waterfront, it does not remove the actual sources of many contaminants.

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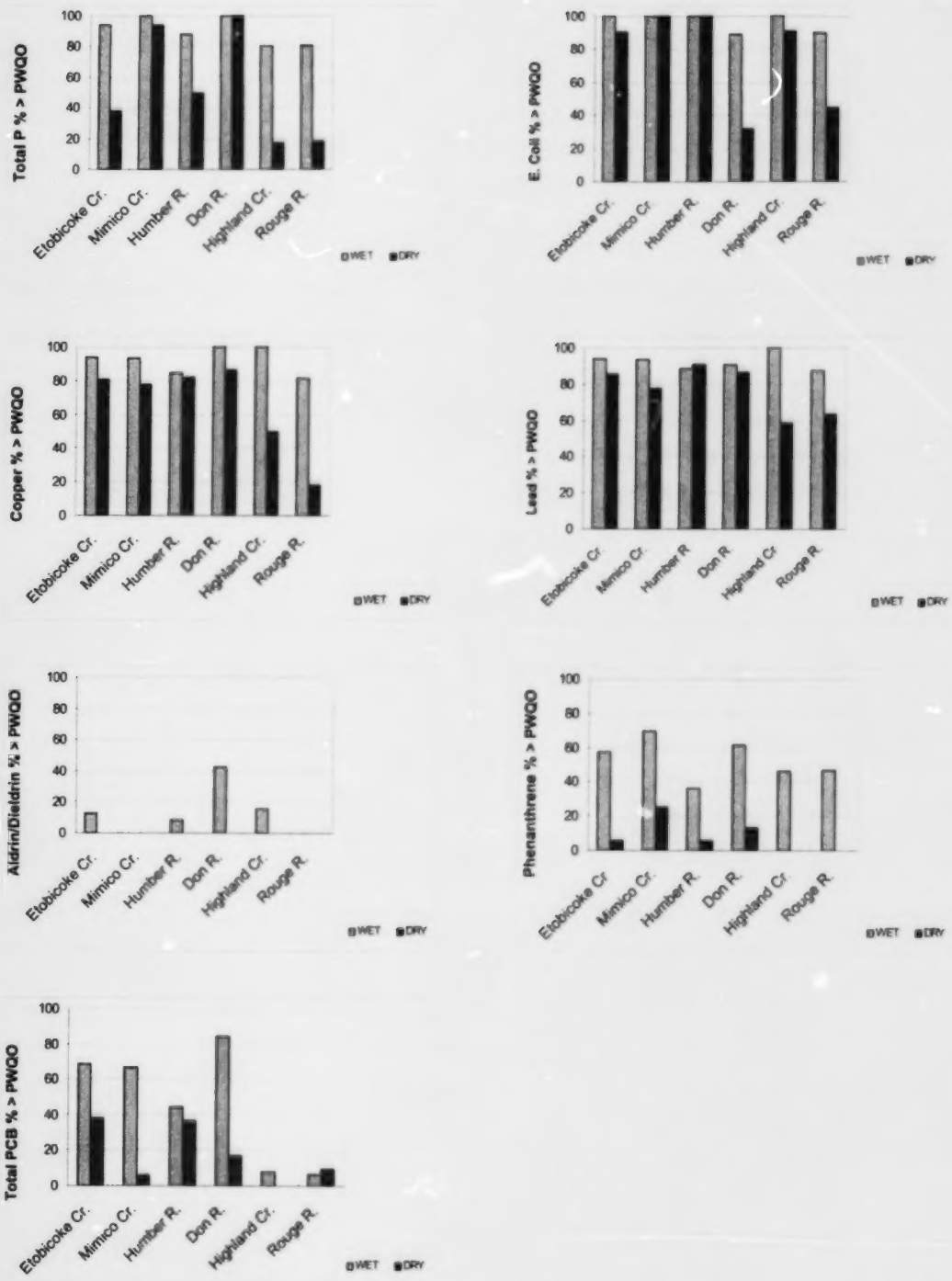

Figure 2.1: Relative Frequency of Detection Above Provincial Water Quality Objectives for Selected Parameters

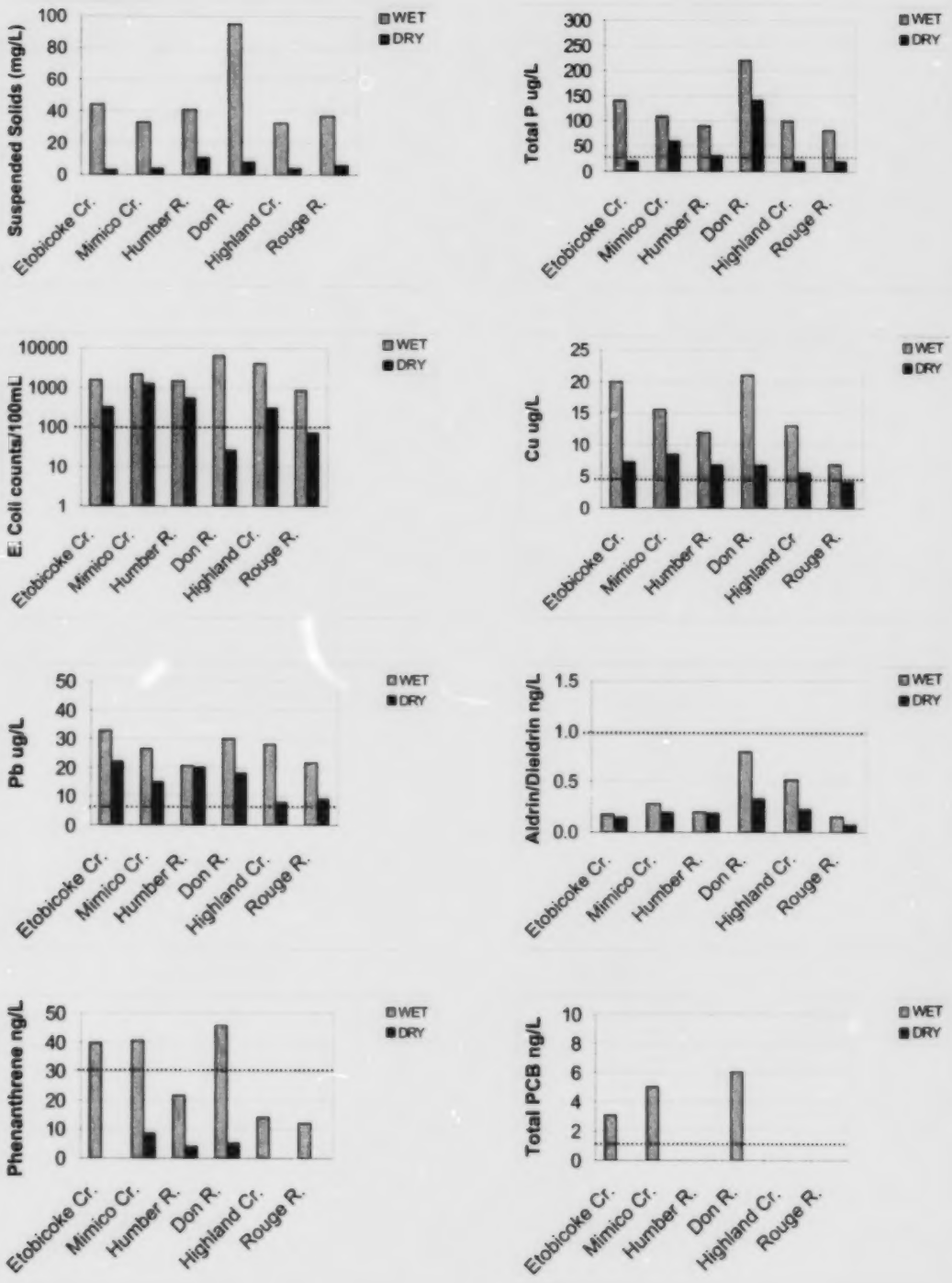

Figure 2.2: Wet and Dry Weather Median Concentrations of Selected Contaminants

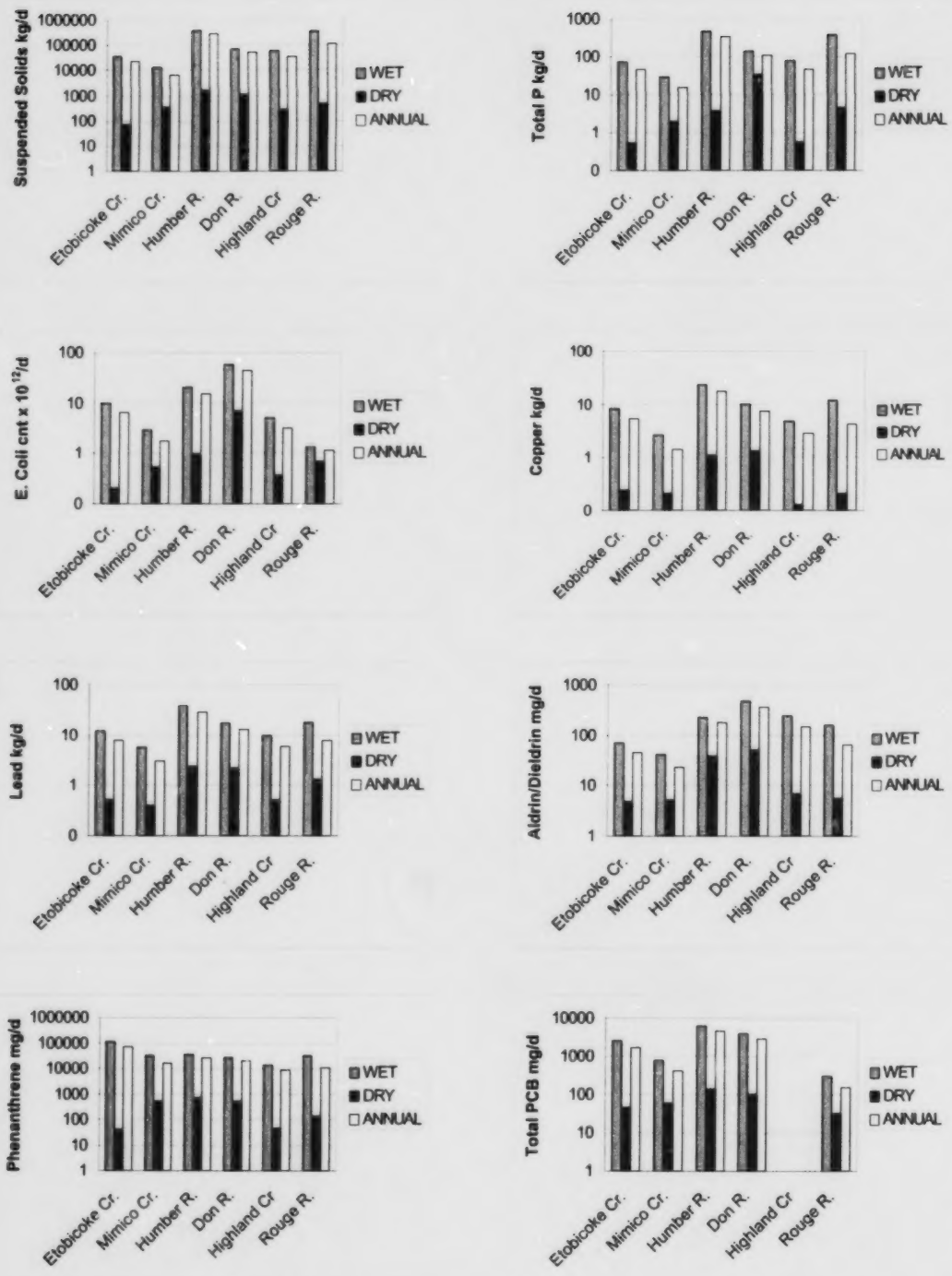

Figure 2.3.1: Summary of Selected Loadings Results

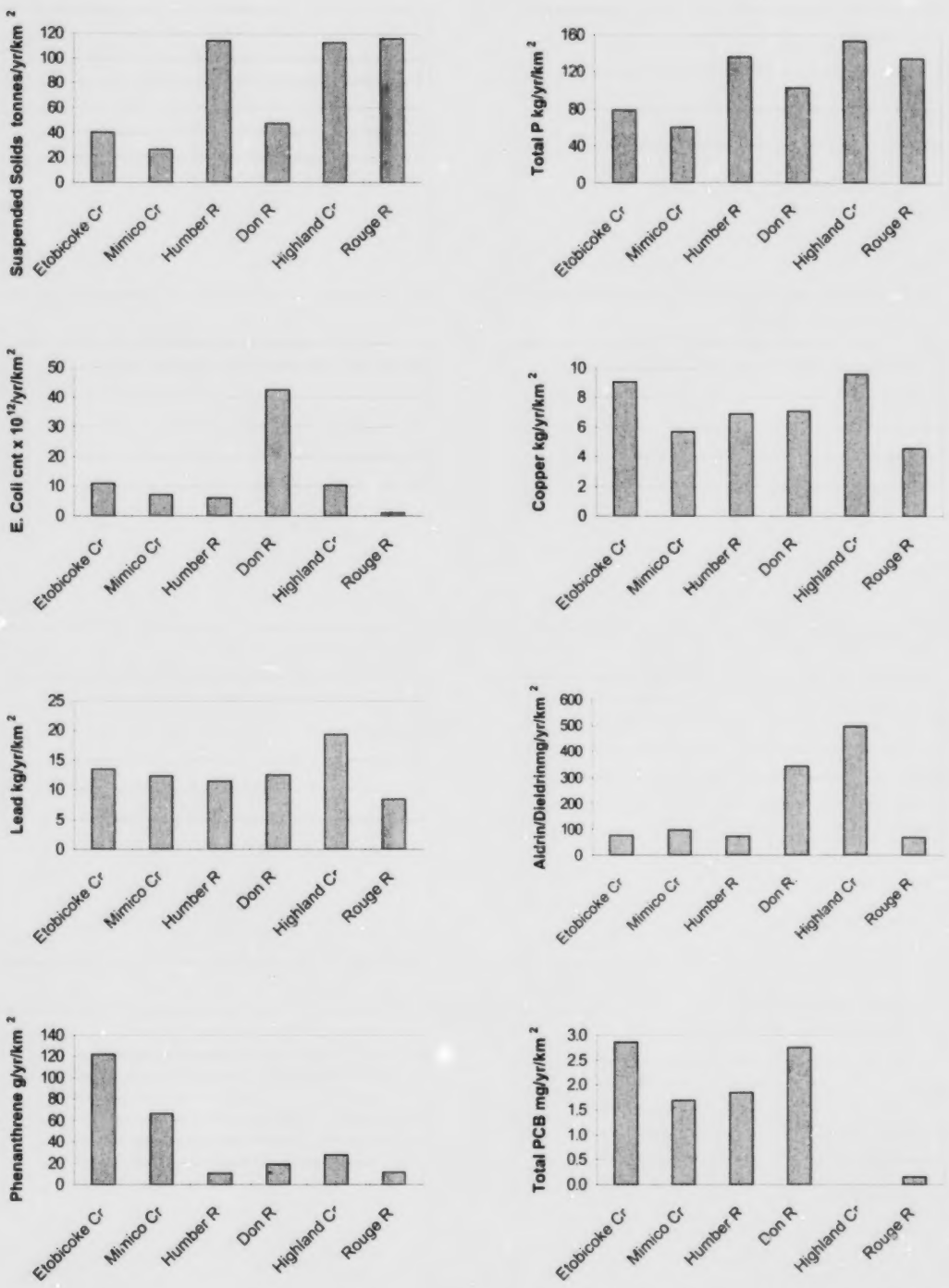

Figure 2.3.2: Summary of Selected Annual Loadings per Unit Area

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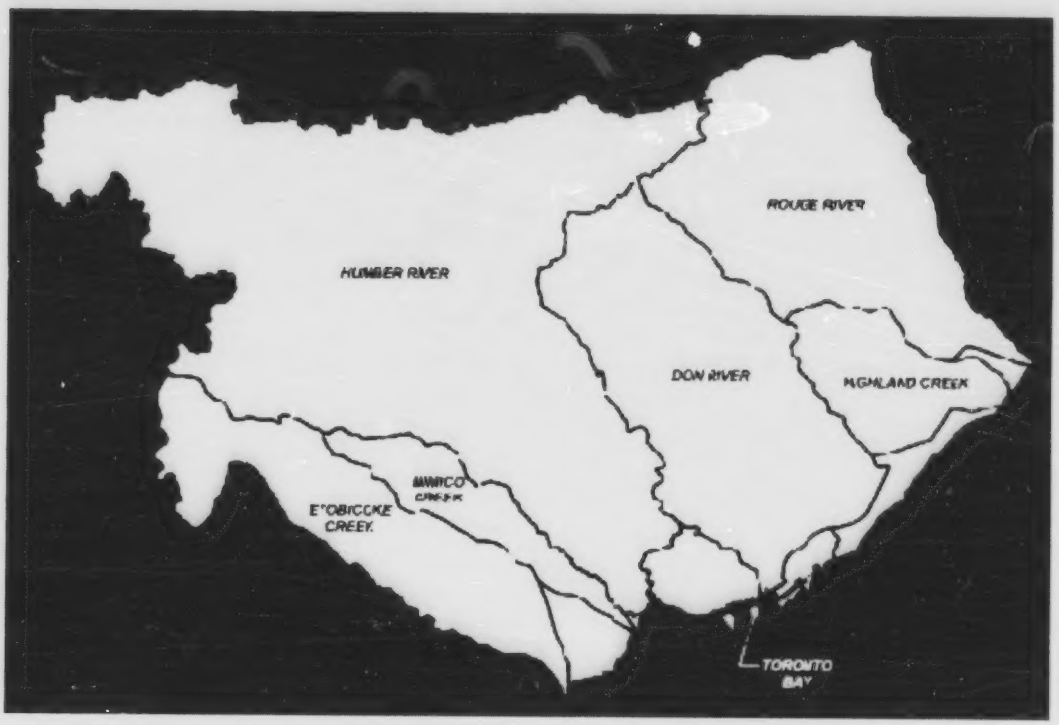

ASSESSMENT OF SIX TRIBUTARY DISCHARGES TO THE TORONTO AREA WATERFRONT VOLUME 2: TECHNICAL APPENDIX AND DATA SUMMARY

Remedial Action Plan
Plan d'assainissement

Canada Ontario

ASSESSMENT OF SIX TRIBUTARY DISCHARGES TO THE TORONTO AREA WATERFRONT

VOLUME 2:

TECHNICAL APPENDIX AND DATA SUMMARY

Report prepared for
The Toronto and Region Remedial Action Plan

by:

Duncan Boyd
Michael D'Andrea
Rod Anderton

Water Monitoring Section
Environmental Monitoring & Reporting Branch
Ontario Ministry of the Environment

MAY 1999

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Foreword

This report completes a series of technical documents prepared on behalf of the Toronto RAP which have also covered assessment of wet and dry weather discharges from sewers and sewage treatment plants. Although the data in this report have been released previously in various forms over the past three years to partners in the Toronto RAP, until now they have not been summarized and submitted for formal publication and distribution to a wider audience.

This Technical Appendix has been prepared for limited distribution to those readers who wish to have access to the entire data set. The companion document entitled: *Assessment of Six Tributary Discharges To the Toronto Area Waterfront Volume 1: Project Synopsis and Selected Results* has been prepared for widespread distribution.

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1.0 FIELD SAMPLING PROTOCOLS

A fibreglass sampling hut was secured on the top of the stream bank with an intake line casing (used to protect the intake line from damage) extending from the sampling hut to the stream sample intake location. The sample hut housed an automatic wastewater sampler and sample containers. Teflon lined polyethylene tubing extended from the stream sample intake location through the intake line casing to the sample hut where it was connected to an ISCO Model 2700 automatic wastewater sampler. Surgical grade silicone tubing was used to pump flows through the peristaltic pump in the sample and connect the pump to a glass flow splitter (Mandel Scientific - Kontes K-655800). Surgical grade silicone tubing was also used to connect each of seven 19 litre stainless steel canisters (soft drink syrup canisters retrofitted with Teflon seals) to the flow splitter. A polyethylene bag was used to line one of the stainless steel canisters and samples from this bag were used for the analysis of non-organic compounds such as heavy metals, nutrients, general chemistry and bacteria. The bag was replaced during each sample collection. Five full sample containers (approximately 100 litres of sample volume in total) were used for the analysis of trace organic compounds. The sixth stainless steel canister was used to "top-up" the sample volume in cases where clogged ports on the flow distributer prevented the collection of a full 100 litres in the five canisters.

A thermostatically controlled (fan operated) electric heater was used in each hut to prevent sample lines within the hut from freezing during winter sampling. In addition, heat wrap cable, connected to AC electrical power, was extended through the intake line casing to prevent sample line freeze-up during the winter. Electrical power (110 volts AC) was available at the two Environment Canada stations and was supplied at the other four stations by Metropolitan Toronto. In some cases AC power was not immediately available and 12 Volt DC power was supplied to operate the automatic sampler during the non-freeze periods.

The automatic sampler was switched on manually and samples were then composited over a 24 hour period as a series of 2 litre aliquots collected at 20 minute intervals. All canisters were pre-cleaned and solvent rinsed prior to sample collection. Samples were split into appropriate containers and prepared prior to submission to the Ontario Ministry of the Environment Laboratories for chemical analyses. Samples for the analysis of volatile trace organic compounds (e.g. chloroform) were collected as two grab samples, using a series of 45 ml EPA vials, at the time of sample initiation and at the time of sample retrieval (about 24 hours later).

Samples were collected over a period of one year under dry and wet weather conditions. At least three samples were collected under each flow condition during each season, with a special emphasis on sample collection during high flow conditions in the spring and summer. Sampling during dry weather was initiated, typically at least 48 hours following a wet weather event. While wet weather sampling was initiated as close to the beginning of higher flow conditions. Tables 1.1 to 1.6 summarize sample collection information at each location.

TABLE 1.1 ETOBICOKE CREEK SAMPLE COLLECTION SUMMARY

ETOBICOKE CREEK		
MOE STATION CODE:	000006-0015-0102	
STATION LOCATION:	Sampler in Environment Canada Station - downstream of QEW on west bank. Intake - downstream of EC station weir.	
SAMPLING STATION TYPE:	EC STN NO. 02HC030	
INTAKE DISTANCE FROM SHORE (m):	2 m	
INTAKE HEIGHT OFF BOTTOM (m):	0.5 m	
FIRST SAMPLE COLLECTED (yy/mm/dd)	91/02/21	
LAST SAMPLE COLLECTED (yy/mm/dd)	92/06/24	

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
91/03/11	91/03/13	Sampler malfunction.
91/11/21	92/01/20	Three sample attempts aborted due to line damage by ice.

NUMBER OF DRY WEATHER SAMPLES	14	
NUMBER OF WET WEATHER SAMPLES	23	
NUMBER OF REPLICATES (conventionals/trace organics)	5 / 1	

TABLE 1.2: MIMICO CREEK SAMPLE COLLECTION SUMMARY

MIMICO CREEK		
MOE STATION CODE:	000006-0015-0103	
STATION LOCATION:	Downstream of QEW on the west bank, at the old Humber Filtration Plant.	
SAMPLING STATION TYPE:	MOE FIBREGLASS HUT	
INTAKE DISTANCE FROM SHORE (m):	3 m	
INTAKE HEIGHT OFF BOTTOM (m):	0.3 m	
FIRST SAMPLE COLLECTED (yy/mm/dd)	91/01/15	
LAST SAMPLE COLLECTED (yy/mm/dd)	92/06/25	

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
91/02/04	91/02/18	Ice took out sample line.
91/04/15	91/04/20	Power to sample hut turned off.
91/05/29	91/05/30	High flows took out sample line.
91/06/11	91/06/17	High flow damaged sample line; conventionals only.
91/10/17	91/11/03	High flow damaged pipe heating line; line froze.
91/12/11	92/02/10	High flows damaged line; aborted 3 samples.

NUMBER OF DRY WEATHER SAMPLES	18	
NUMBER OF WET WEATHER SAMPLES	16	
NUMBER OF REPLICATES (conventionals/trace organics)	3 / 1	

TABLE 1.3: HUMBER RIVER SAMPLE COLLECTION SUMMARY

HUMBER RIVER		
MOE STATION CODE:	000006-0015-0104	
STATION LOCATION:	Humber Valley Yacht Club - downstream of Bloor Street on west bank.	
SAMPLING STATION TYPE:	MOE FIBREGLASS HUT	
INTAKE DISTANCE FROM SHORE (m):	3 m winter 10 m summer	
INTAKE HEIGHT OFF BOTTOM (m):	1 m winter 3 m summer	
FIRST SAMPLE COLLECTED (yy/mm/dd)	90/11/27	
LAST SAMPLE COLLECTED (yy/mm/dd)	92/02/18	

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
90/12/27	91/01/02	Ice took out sample line.

NUMBER OF DRY WEATHER SAMPLES	24	
NUMBER OF WET WEATHER SAMPLES	24	
NUMBER OF REPLICATES (conventionals/trace organics)	3 / 0	

TABLE 1.4: DON RIVER SAMPLE COLLECTION SUMMARY

DON RIVER		
MOE STATION CODE:	000006-0015-0105	
STATION LOCATION:	Sampler in Water Survey of Canada Station - downstream of Pottery Road on east bank. Intake line - through EC station wet well intake.	
SAMPLING STATION TYPE:	EC STN NO. 02HC024	
INTAKE DISTANCE FROM SHORE (m):	3 m	
INTAKE HEIGHT OFF BOTTOM (m):	0.8 m	
FIRST SAMPLE COLLECTED (yy/mm/dd)	90/11/18	
LAST SAMPLE COLLECTED (yy/mm/dd)	92/03/16	

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
91/03/27	91/03/28	Blockage caused sample line to break connection.
91/04/15	91/04/21	Blockage caused sample line to break connection.
91/12/12	92/02/18	EC Stn. lock was vandalized, could not get into station.

NUMBER OF DRY WEATHER SAMPLES	22	
NUMBER OF WET WEATHER SAMPLES	24	
NUMBER OF REPLICATES (conventionals/trace organics)	5 / 1	

TABLE 1.5: HIGHLAND CREEK SAMPLE COLLECTIONS SUMMARY

HIGHLAND CREEK	
MOE STATION CODE:	000006-0015-0106
STATION LOCATION:	In Colonel Danforth Park
	1st location: 100 m downstream of Kingston Rd on east bank (91/07/02 - 91/10/18)
	2nd location: downstream of the Highland Creek Dr. bridge, near public washrooms on the west bank (92/02/10 - 92/09/18)
SAMPLING STATION TYPE:	MOE FIBREGLASS HUT
INTAKE DISTANCE FROM SHORE (m):	1st: 2 m 2nd: 3 m
INTAKE HEIGHT OFF BOTTOM (m):	1st: 0.4 m 2nd: 0.4 m
FIRST SAMPLE COLLECTED (yy/mm/dd)	91/07/02
LAST SAMPLE COLLECTED (yy/mm/dd)	92/09/18

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
91/10/18	92/02/10	No power to sample hut and heaters: lines froze. Power lines later installed by Metro Works at 2nd location.
92/03/10	92/03/24	Debris clogged line, only samples for conventional analyses collected.
92/03/28	92/04/21	High flows and ice damaged sample line, two samples aborted.
92/04/24	92/06/17	Power supply to sample hut disconnected.
92/07/22	92/08/27	Large tree fell on sample line, heavy flows damaged line; three samples aborted.

NUMBER OF DRY WEATHER SAMPLES	12
NUMBER OF WET WEATHER SAMPLES	15
NUMBER OF REPLICATES (conventionals/trace organics)	13 / 4

TABLE 1.6: ROUGE RIVER SAMPLE COLLECTION SUMMARY

ROUGE RIVER		
MOE STATION CODE:	000006-0015-0107	
STATION LOCATION:	Glen Rouge Park - near footbridge closest to parking lot on west bank. Upstream of Little Rouge confluence.	
SAMPLING STATION TYPE:	MOE FIBREGLASS HUT	
INTAKE DISTANCE FROM SHORE (m):	3 m	
INTAKE HEIGHT OFF BOTTOM (m):	1 m	
FIRST SAMPLE COLLECTED (yy/mm/dd)	91/07/17	
LAST SAMPLE COLLECTED (yy/mm/dd)	92/09/18	

SAMPLING STATION DOWN-TIME		
FROM (yy/mm/dd)	TO (yy/mm/dd)	EXPLANATION
91/10/18	91/11/19	No power to heater in hut - temperature below zero.
91/11/21	92/02/10	No power to heater - power line being installed by Metro.
92/04/01	92/05/01	Ice and extremely high flows took out sample line.

NUMBER OF DRY WEATHER SAMPLES	11	
NUMBER OF WET WEATHER SAMPLES	17	
NUMBER OF REPLICATES (conventionals/trace organics)	16 / 5	

2.0 FLOW DATA AND HYDROGRAPHS

Flow data were obtained through Environment Canada's stream flow monitoring program. Data were obtained in electronic format for those stations located closest to the mouth of the watercourse. The station description and identification codes are presented in Table 2.1. The table also presents the drainage area represented at the flow gauge, as estimated by the Water Survey of Canada, and the total watershed area as estimated by the Metropolitan Toronto and Region Conservation Authority. In most cases, the drainage area at the flow gauge represented less than 90% of the total watershed area. Accordingly, the measured flows were prorated, by area, to the entire drainage area. Estimates of total discharge for the Humber and Rouge Rivers required the summation of flow data collected at two stations, respectively.

Mean daily flows for each 24 hour time composited sample were obtained as average values for flow data collected by the Water Survey of Canada at 15 minute intervals. Average daily flows obtained from the Water Survey of Canada, were however, used for contaminant mass loadings and evaluations of historical averages were obtained as daily averages.

TABLE 2.1: FLOW GAUGING STATION SUMMARY

Station Location	EC Station Identification	Drainage Area at Gauging Station (km^2) (A)	Watershed Area at mouth (km^2) (B)	Ratio* of Watershed Area to Drainage Area Gauged (B)÷(A)
ETOBICOKE CREEK - below the QEW	02HC030	204	207.2	1.0
MIMICO CREEK - at Islington	02HC033	70.6	78.2	1.11
HUMBER RIVER				
- at Weston Road	02HC003	800		
- Black Creek, near Weston Road	02HC027	58		
		(TOTAL) 858	857.2	1.0
DON RIVER - at Todmorden	02HC024	316	360.5	1.14
HIGHLAND CREEK - near West Hill	02HC013	86.2	106.6	1.24
ROUGE RIVER - near Markham	02HC022	186	214.8	1.15
- Little Rouge, near Locust Hill	02HC028	77.7	112.6	1.45
		(TOTAL) 263.7	327.4	1.24

NOTE: * - Ratio used in prorating watershed flows measured at EC stations to estimate flows at the tributary mouth for contaminant mass loadings analyses.

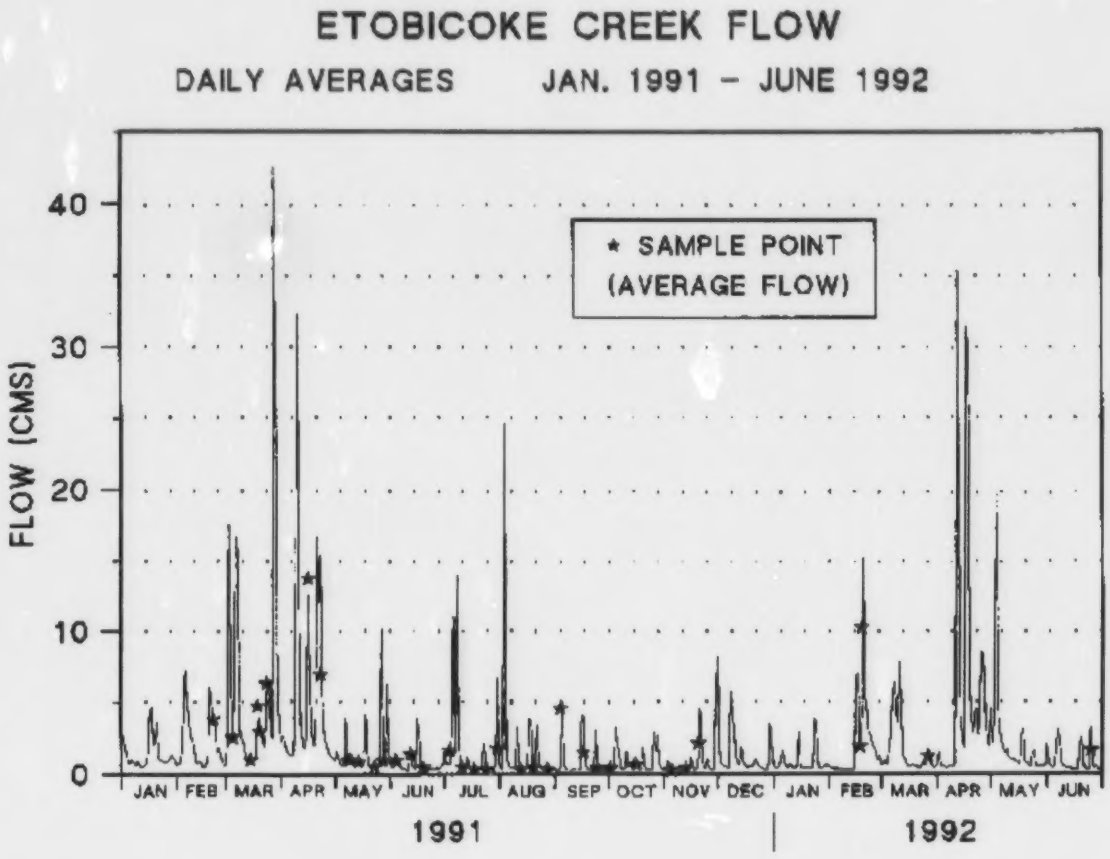

Figure 2.1 Hydrograph for Etobicoke Creek

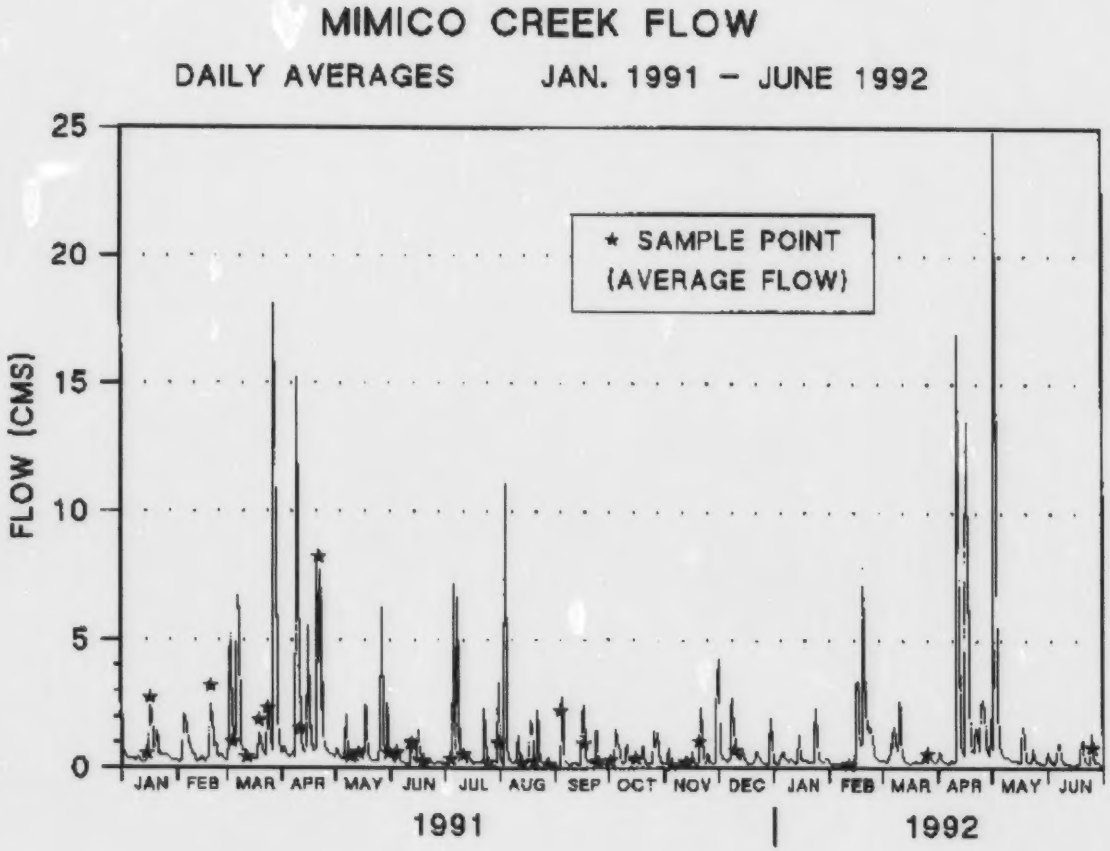

Figure 2.2 Hydrograph for Mimico Creek

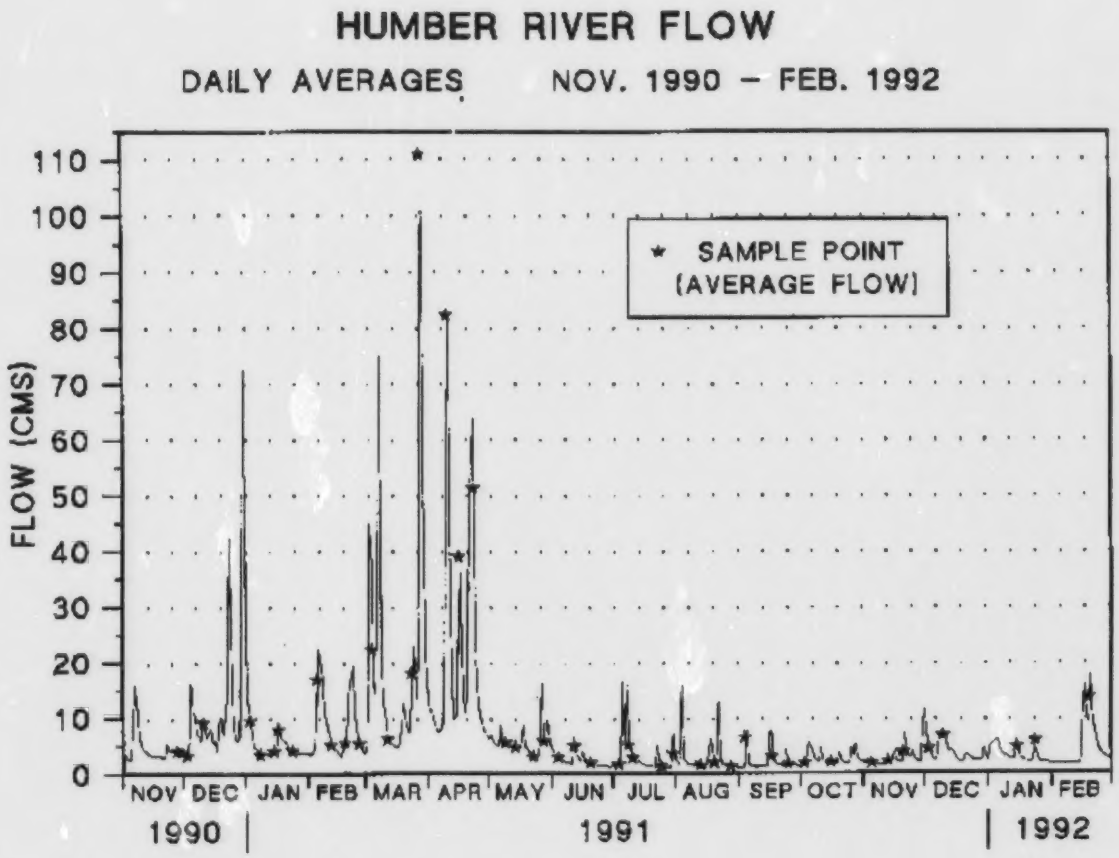

Figure 2.3 Hydrograph for Humber River

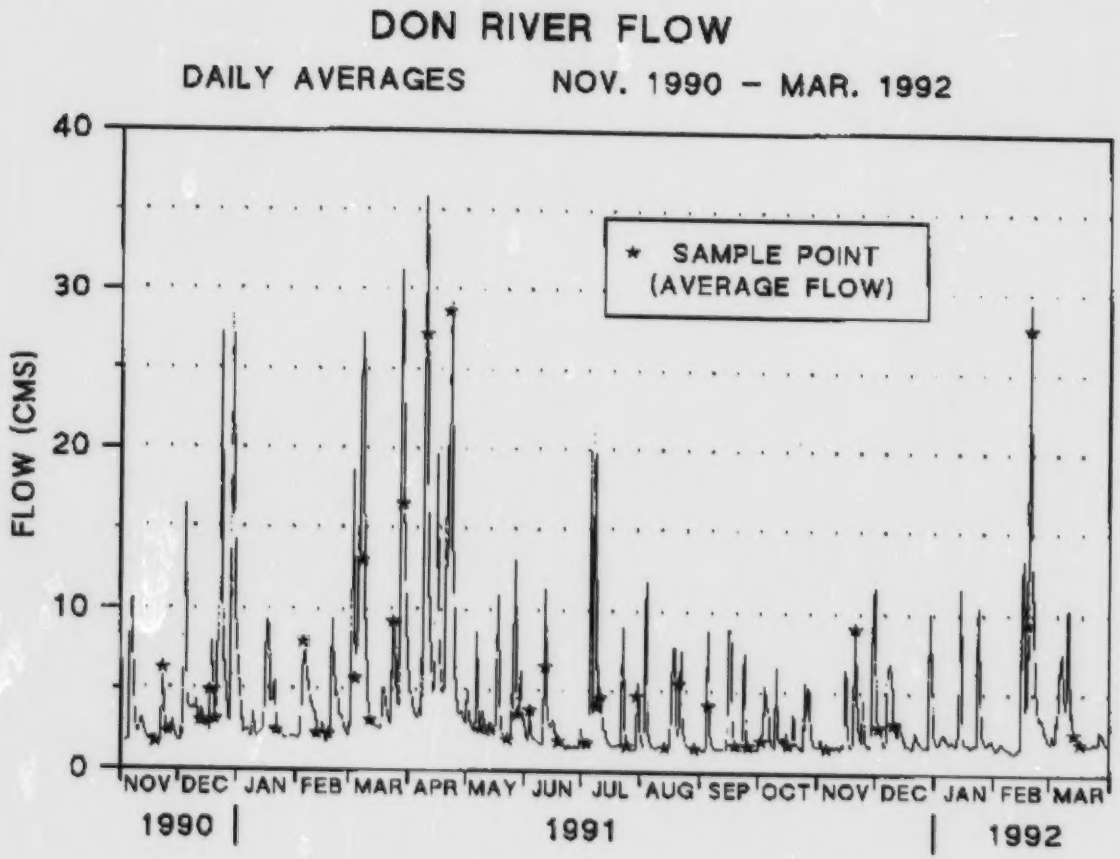

Figure 2.4 Hydrograph for Don River

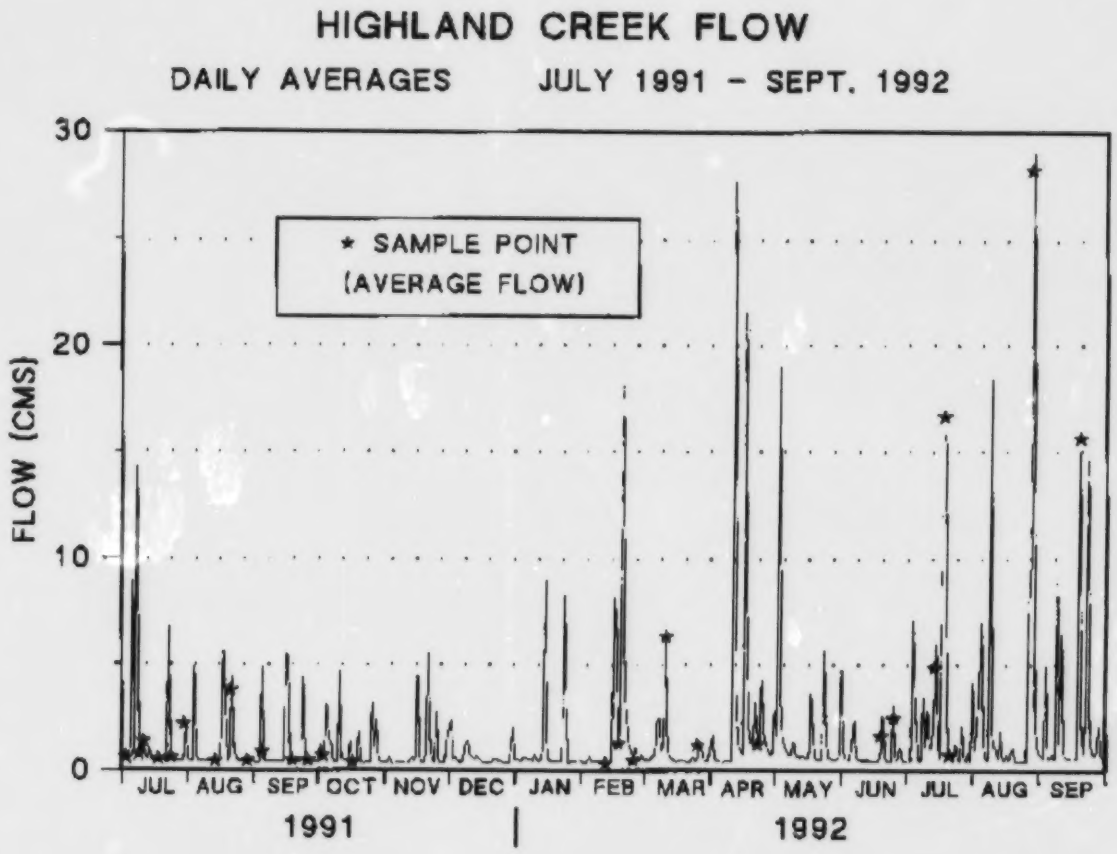

Figure 2.5 Hydrograph for Highland Creek

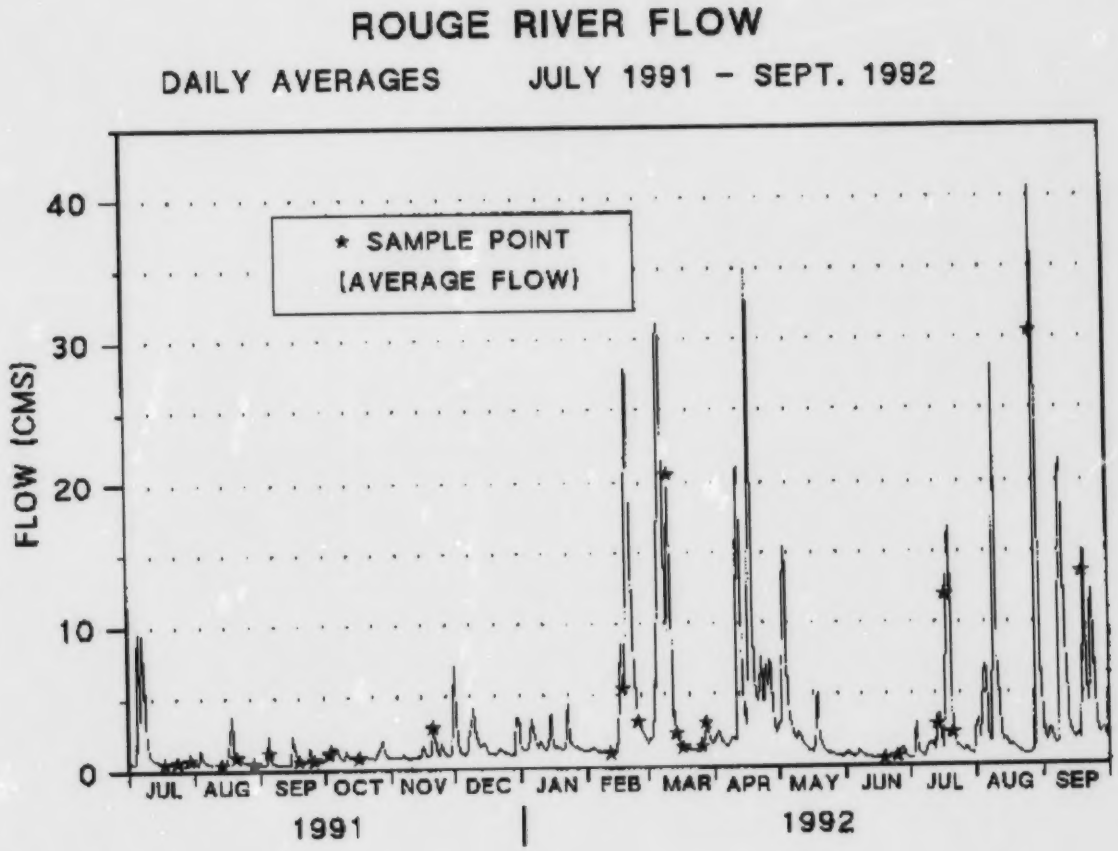

Figure 2.6 Hydrograph for Rouge River

3.0 SAMPLE ANALYSIS

With the exception of the large volume (100 litre) trace organics analyses of chlorobenzenes, organochlorine pesticides, polynuclear aromatic hydrocarbons (PAHs) and PCBs, the Ontario Ministry of the Environment Laboratory Services Branch performed the chemical analysis for all compounds. Analytical methodologies described in MOE (1988) were used in these analyses.

Mann Testing Laboratories performed the chemical analysis of the large volume samples for the above-mentioned trace organic compounds. The analytical procedure involved using a Goulden Extractor for the solvent extraction of the unfiltered sample (liquid-liquid extraction using DCM). The concentration, cleanup and analysis using a dual column/dual electron capture detector followed the methodology described in MOE (1988); except for the analysis of PAH compounds which used a mass spectrometer detector.

4.0 STATISTICAL TECHNIQUES AND LOADING COMPUTATIONS

Statistical summaries are presented as an estimate of the mean with the corresponding 95% confidence interval, wherever possible. Many of the contaminant concentration data sets used in this study are left-censored however (i.e. containing data at or below the analytical detection limit) and statistical evaluation of these data sets requires the use of non-traditional techniques.

Probability distribution estimation (PDE) techniques were used to estimate the mean and corresponding confidence interval for the data sets containing censored data. These techniques use the probability distribution of the non-censored data (data above the detection limit) to estimate the statistical properties of the entire data set. One of these techniques, the maximum likelihood estimation (MLE) method is widely accepted for the statistical description of left-censored water chemistry data (Cohen 1959, Gilbert 1987, and El-Sharaawi and Dolan 1989), and was one technique used in this study. It provides an estimate of the mean and standard deviation of the data set by using estimates of the statistical properties of the non-censored data. It is recommended for use when up to 80% of the distribution is censored and where there is a minimum of three non-censored values.

A more traditional approach such as substituting a fraction (generally 0.5) of the analytical detection limit value for those values which were at or below the detection limit was used when the data characteristics did not permit the application of the PDE techniques. This approach was used to provide only qualitative mean estimates of the data. Confidence intervals were not presented because they are biassed by the substituted data.

MOE data files were modified to include two additional fields identifying the climatological conditions under which the samples were collected (i.e. dry or wet weather) and the season during which the sample was collected. General statistical information such as the frequency of contaminant detection, estimates of mean concentration and corresponding confidence intervals were provided by climatological condition.

Contaminant mass loading estimates were generated for each tributary using the Beale Ratio

Estimator technique; a well established approach for the estimation of tributary contaminant mass loadings when continuous flow data and discrete water chemistry data are available (Dolan *et al.* 1981). This method derives the ratio of the mean of measured loads to the mean of their corresponding flow measurements which is then combined with the mean of actual flow to yield an overall loading estimate. The estimate can be improved by partitioning the data set into strata based on flow driven relationships with contaminant concentration. In this study, the Beale Ratio Estimator was used with dry weather ("low") and wet weather ("high") flow strata (except for the Rouge River which used one low flow stratum and two high flow strata) to generate estimates of mass discharges and the associated 95% confidence interval for those cases where the water chemistry sample size was sufficiently large to provide reasonable estimates. For most tributaries this was possible for estimations of annual, and wet and dry weather loadings.

It should be emphasized that this technique was applied using flow and water chemistry data collected during this study period only. Each tributary was sampled for a period of one year within the overall two year window and extreme conditions such as large storms or lower than average spring flows resulting from below average snow accumulation (as was experienced in 1992) will have influenced the estimates of contaminant mass loadings. As a consequence, results presented here should be considered representative of relative loadings among tributaries rather than long-term average conditions.

5. 0 RESULTS

Complete wet and dry weather water quality results (means, 95% confidence intervals) for all parameters are summarized for all six tributaries in Tables 5.1 - 5.6.

Complete wet weather, dry weather, and annual loading summaries based on the Beale Ratio Estimator technique with two flow strata are supplied for all six tributaries. In Tables 5.7 to 5.12. Corresponding estimates of the error (bias and precision) associated with calculated loads are also provided using the Root Mean Square Error (RMSE).

TABLE 5.1: ETOBICOKE CREEK : SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chemical Parameters													
Alkalinity	mg/L	21	100.0	167.5		154.0	182.2	15	100.0	139.1		125.0	154.8
Chemical Oxygen Demand	mg/L	21	100.0	31.4		22.7	43.5	16	100.0	66.3		45.5	96.7
Conductivity	uU/cm	21	100.0	1420.1		1160.4	1738.0	16	100.0	2297.2		1404.4	3757.6
Chloride	mg/L	4	100.0	793.6		134.9	4668.7	5	100.0	963.6		224.7	4131.9
Cyanide, Available	mg/L							16	50.0	0.005	MLE	0.002	0.011
Cyanide, Free	mg/L							16	25.0	0.001	MLE	0.000	0.003
pH	none	21	100.0	8.286		8.231	8.342	16	100.0	8.009		7.875	8.145
Phenols	ug/L	21	90.5	1.46	MLE	0.88	2.40	16	100.0	2.59		1.55	4.31
Suspended Solids	mg/L	21	100.0	7.39		4.64	11.77	16	100.0	87.27		44.50	171.17
Total Solids	mg/L	21	100.0	910.4		756.8	1095.1	16	100.0	1198.4		680.6	1210.3
Turbidity	FTU	21	100.0	6.7		3.6	12.5	16	100.0	60.9		30.9	120.1
Nutrients													
Ammonium	mg/L	21	57.1	0.21	MLE	0.10	0.44	16	81.3	1.28	MLE	0.47	3.48
Nitrates	mg/L	20	100.0	0.78		0.57	1.07	16	100.0	1.20		0.87	1.66
Nitrites	mg/L	21	100.0	0.037		0.025	0.056	16	100.0	0.128		0.077	0.214
Total Kjeldahl Nitrogen	mg/L	21	100.0	0.84		0.62	1.15	16	100.0	3.15		1.82	5.46
Phosphorus	mg/L	21	81.0	0.03	MLE	0.03	0.05	16	100.0	0.21		0.12	0.36

TABLE 5.1 ETOBICOKE CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Bacteria													
Escherichia Coliform	#/dL	21	100.0	929		528	1634	12	100.0	3278		1518	7076
Fecal Coliform	#/dL	21	100.0	1127		632	2009	12	100.0	4442		1907	10345
Fecal Streptococcus	#/dL	21	100.0	548		291	1034	12	100.0	2540		1038	6217
Pseudomonas Aeruginosa	#/dL	21	100.0	31		16	60	12	100.0	459		130	1617
Metals													
Aluminum	mg/L	21	100.0	0.267		0.153	0.466	16	100.0	2.185		1.100	4.342
Barium	mg/L	21	100.0	0.0485		0.0443	0.0532	16	100.0	0.0533		0.0432	0.0657
Beryllium	mg/L	21	42.9	0.00026	HDL	0.00011	0.00062	16	62.5	0.00047	MLE	0.00016	0.00137
Cadmium	mg/L	21	66.7	0.0038	MLE	0.0016	0.0088	16	81.3	0.0013	MLE	0.0007	0.0022
Chromium	mg/L	21	81.0	0.008	MLE	0.005	0.014	16	100.0	0.010		0.007	0.015
Copper	mg/L	21	100.0	0.0104		0.0077	0.0141	15	100.0	0.0231		0.0158	0.0338
Iron	mg/L	20	100.0	0.46		0.27	0.77	16	100.0	3.91		2.01	7.61
Lead	mg/L	21	85.7	0.026	MLE	0.017	0.039	16	93.8	0.036	MLE	0.022	0.060
Manganese	mg/L	20	100.0	0.0470		0.0270	0.0817	16	100.0	0.1917		0.1063	0.3457
Nickel	mg/L	21	95.2	0.007	MLE	0.005	0.011	16	100.0	0.015		0.008	0.027
Silver	mg/L	21	42.9	0.0015	MLE	0.0007	0.0031	16	50.0	0.0020	MLE	0.0008	0.0046
Zinc	mg/L	21	85.7	0.019	MLE	0.011	0.032	16	87.5	0.173	MLE	0.067	0.447

TABLE 5.1: ETOBICOKE CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Metalloids													
Arsenic	mg/L							16	25.0	0.001	MLE	0.001	0.002
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L							16	37.5	60.0	MLE	36.6	98.5
Organochlorine Pesticides													
Total PCB's	ng/L	21	38.1	3.7	MLE	1.6	8.8	16	68.8	19.1	MLE	6.7	54.7
Alpha - BHC	ng/L	20	100.0	0.66		0.57	0.77	14	100.0	0.95		0.61	1.48
Gamma - BHC	ng/L	21	100.0	0.66		0.53	0.83	14	100.0	0.89		0.59	1.33
Alpha - Chlordane	ng/L	21	57.1	0.09	MLE	0.05	0.18	16	81.3	0.14	MLE	0.08	0.26
Gamma - Chlordane	ng/L	21	57.1	0.05	MLE	0.03	0.08	16	75.0	0.14	MLE	0.07	0.28
Dieldrin	ng/L	21	100.0	0.19		0.15	0.25	16	75.0	0.49	MLE	0.20	1.20
DMDT - Methoxychlor	ng/L	21	23.8	0.08	HDL	0.05	0.15	16	37.5	0.23	MLE	0.07	0.71
Thiodan Sulphate	ng/L	21	76.2	0.65	MLE	0.32	1.32	16	56.3	0.66	HDL	0.25	1.72
Thiodan I	ng/L	21	38.1	0.11	HDL	0.05	0.22	16	43.8	0.38	HDL	0.13	1.13
Heptachlorepoxide	ng/L	21	47.6	0.03	MLE	0.02	0.05	16	43.8	0.07	MLE	0.03	0.16
OP - DDT	ng/L							16	25.0	0.09	MLE	0.03	0.26
PP - DDD	ng/L	21	38.1	0.07	MLE	0.04	0.13	16	50.0	0.08	MLE	0.05	0.12
PP - DDE	ng/L	21	33.3	0.07	HDL	0.03	0.14	16	56.3	0.17	HDL	0.06	0.44
PP - DDT	ng/L	21	23.8	0.09	HDL	0.05	0.16	16	56.3	0.46	MLE	0.16	1.31

TABLE 5.1: ETOBICOKE CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chlorobenzene Pesticides													
Hexachlorobenzene	ng/L	21	33.3	0.02	MLE	0.01	0.05	16	37.5	0.03	HDL	0.02	0.07
Hexachloroethane	ng/L	21	23.8	0.01	MLE	0.01	0.03						
Pentachlorobenzene	ng/L	21	61.9	0.09	MLE	0.04	0.20	16	62.5	0.26	MLE	0.08	0.78
1,2,4 - Trichlorobenzene	ng/L	21	71.4	2.59	HDL	0.96	7.04	16	81.3	3.19	MLE	1.02	10.01
Polynuclear Aromatic Hydrocarbons													
Acenaphthene	ng/L							14	35.7	17.4	HDL	5.3	57.2
Anthracene	ng/L							14	35.7	18.8	HDL	5.6	63.2
Benzo (A) Anthracene	ng/L							14	78.6	161.2	HDL	43.2	602.0
Benzo (A) Pyrene	ng/L	18	27.8	2.1	HDL	1.1	3.8	14	78.6	324.7	HDL	78.8	1338.4
Benzo (B) Fluoranthene {FA}	ng/L	18	55.6	15.9	HDL	6.2	40.9	14	92.9	386.7	MLE	113.7	1314.7
Benzo (G-H-I) Perylene	ng/L	18	33.3	3.3	HDL	1.6	6.7	14	78.6	362.3	HDL	87.2	1505.1
Chrysene	ng/L	18	50.0	6.9	HDL	3.0	15.5	14	92.9	315.1	MLE	91.2	1088.8
Fluoranthene	ng/L	18	77.8	20.7	MLE	8.7	49.1	14	100.0	627.1		190.5	2064.4
Fluorene	ng/L							14	50.0	68.8	HDL	17.3	273.3
Indeno (1,2,3 - C,D) Pyrene	ng/L	18	27.8	2.5	HDL	1.3	4.9	14	78.6	329.0	HDL	78.8	1373.0
1 - Methylnaphthalene	ng/L							14	42.9	165.1	HDL	34.5	790.0
2 - Methylnaphthalene	ng/L							14	50.0	136.8	HDL	30.6	611.9
Naphthalene	ng/L	18	44.4	8.5	MLE	2.8	26.1	14	42.9	16.4	HDL	5.2	51.3
Phenanthrene	ng/L	18	33.3	5.8	HDL	2.5	13.2	14	78.6	484.3	MVU	98.2	2388.2
Pyrene	ng/L	18	88.9	22.4	MLE	11.1	45.4	14	92.9	906.1	MLE	233.5	3515.9

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Volatile Organics													
Bromoform	ng/L	21	47.6	21.0	MLE	18.0	24.4						
Chlorodibromomethane	ng/L	21	95.2	41.8	MLE	35.3	49.5	14	78.6	27.4	MLE	21.7	34.5
Chloroform	ng/L	21	100.0	135.3		109.7	166.9	14	100.0	94.9		72.2	124.6
Dichlorobromomethane	ng/L	21	100.0	51.6		43.1	61.8	14	85.7	34.5	MLE	27.2	43.7
Dichloroethane	ng/L	21	28.6	17.0	MLE	11.3	25.6	14	50.0	23.3	MLE	16.3	33.3
Ethylbenzene	ng/L							14	21.4	16.3	MLE	13.3	19.9
Tetrachloroethylene	ng/L							14	78.6	31.5	MLE	23.6	42.1
Toluene	ng/L							13	23.1	48.6	MLE	12.9	183.0
1,1,1 - Trichloroethane	ng/L	21	95.2	52.4	MLE	39.0	70.3	13	100.0	109.1		73.4	162.3
Trichloroethylene	ng/L	21	100.0	123.3		84.8	179.2	14	100.0	259.5		147.0	458.1
O - Xylene	ng/L							14	21.4	141.5	MLE	13.2	187.6
P - Xylene	ng/L							14	28.6	19.0	MLE	10.9	33.0

NOTE:

- Blanks in the Mean column indicate below 20% of samples were above detection limits.
MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL
MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value
HDL - <W Values Were Replaced By Half The Detection Limit Value
GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.2: MIMICO CREEK: SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chemical Parameters													
Alkalinity	mg/L	17	100.0	177.5		160.8	196.0	16	100.0	142.6		124.1	163.8
Chemical Oxygen Demand	mg/L	18	100.0	41.3		26.9	63.5	16	100.0	65.6		43.9	97.9
Conductivity	uU/cm	17	100.0	1880.3		1407.0	2512.8	16	100.0	2385.4		1458.1	3902.5
Chloride	mg/L	4	100.0	510.3		153.4	1697.4	3	100.0	974.4		25.9	36624.4
Cyanide, Available	mg/L							16	37.5	0.009	HDL	0.003	0.024
pH	none	17	100.0	8.173		8.074	8.272	16	100.0	7.998		7.880	8.117
Phenols	ug/L	18	94.4	1.02	MLE	0.72	1.45	16	100.0	3.17		1.80	5.58
Suspended Solids	mg/L	18	100.0	7.97		5.016	12.659	16	100.0	74.15		40.97	134.20
Total Solids	mg/L	18	100.0	1112.6		860.8	1438.0	15	100.0	1470.5		913.1	2368.3
Turbidity	FTU	18	100.0	5.9		3.1	11.3	16	100.0	49.1		25.4	94.9
Nutrients													
Ammonium	mg/L	18	55.6	0.09	MLE	0.05	0.15	16	68.8	0.18	MLE	0.09	0.36
Nitrates	mg/L	17	100.0	0.88		0.66	1.17	15	100.0	0.92		0.74	1.14
Nitrites	mg/L	18	100.0	0.050		0.035	0.072	16	100.0	0.127		0.066	0.246
Total Kjeldahl Nitrogen	mg/L	18	100.0	0.78		0.61	1.00	16	100.0	1.64		1.18	2.27
Phosphorus	mg/L	18	94.4	0.06	MLE	0.05	0.08	16	100.0	0.19		0.13	0.27
Bacteria													
Escherichia Coliform	#/dL	18	100.0	3084		1652	5757	13	100.0	3338		1882	5920
Fecal Coliform	#/dL	18	100.0	4411		2230	8723	13	100.0	5179		2836	9459

TABLE 5.2: MIMICO CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Fecal Streptococcus	#/dL	18	100.0	2629		1258	5494	13	100.0	3193		1569	6498
Pseudomonas Aeruginosa	#/dL	18	100.0	120		52	274	13	100.0	134		59	305
Metals													
Aluminum	mg/L	18	100.0	0.274		0.154	0.487	15	100.0	1.799		0.820	3.948
Barium	mg/L	18	100.0	0.0514		0.0456	0.0580	16	100.0	0.0548		0.0438	0.0686
Beryllium	mg/L	18	44.4	0.00018	HDL	0.00008	0.00043	16	50.0	0.00026	HDL	0.00010	0.00069
Cadmium	mg/L	18	61.1	0.0042	MLE	0.0015	0.0116	15	80.0	0.0020	MLE	0.0010	0.0041
Chromium	mg/L	18	94.4	0.007	MLE	0.005	0.010	16	93.8	0.010	MLE	0.006	0.015
Copper	mg/L	18	100.0	0.0095		0.0076	0.0119	16	100.0	0.0205		0.0132	0.0318
Iron	mg/L	18	100.0	0.40		0.25	0.62	14	100.0	3.47		1.77	6.78
Lead	mg/L	18	77.8	0.019	MLE	0.012	0.028	15	93.3	0.040	MLE	0.025	0.066
Manganese	mg/L	18	100.0	0.0819		0.0453	0.1483	15	100.0	0.2004		0.1155	0.3477
Mercury	ug/L							15	33.3	0.02	MLE	0.01	0.03
Nickel	mg/L	18	88.9	0.007	MLE	0.004	0.010	16	87.5	0.010	MLE	0.006	0.018
Silver	mg/L	18	72.2	0.0028	MLE	0.0015	0.0052	16	50.0	0.0060	MLE	0.0019	0.0186
Zinc	mg/L	18	88.9	0.024	MLE	0.014	0.042	16	100.0	0.100		0.050	0.203
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L	18	33.3	49.6	MLE	33.2	74.1	16	68.8	96.0	MLE	64.3	143.3
Organochlorine Pesticides													
Total PCB's	ng/L							15	66.7	12.4	MLE	4.8	31.9
Alpha - BHC	ng/L	18	100.0	0.59		0.46	0.75	13	100.0	0.95		0.66	1.38

TABLE 5.2: MIMICO CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Beta - BHC	ng/L							15	20.0	0.03	HDL	0.01	0.06
Gamma - BHC	ng/L	18	100.0	0.48		0.38	0.60	12	100.0	1.13		0.67	1.91
Alpha - Chlordane	ng/L	18	94.4	0.11	MLE	0.07	0.17	15	80.0	0.46	MLE	0.19	1.10
Gamma - Chlordane	ng/L	18	88.9	0.07	MLE	0.05	0.10	15	80.0	0.42	MLE	0.17	1.02
Dieldrin	ng/L	18	94.4	0.24	MLE	0.16	0.35	15	80.0	0.66	MLE	0.27	1.59
DMDT - Methoxychlor	ng/L	18	44.4	0.28	MLE	0.10	0.77	15	60.0	1.13	HDL	0.38	3.37
Thiodan Sulphate	ng/L	18	94.4	0.45	MLE	0.28	0.71	15	60.0	1.20	HDL	0.41	3.49
Thiodan I	ng/L	18	88.9	0.34	MLE	0.19	0.60	15	66.7	1.01	HDL	0.33	3.08
Thiodan II	ng/L							15	20.0	0.10	HDL	0.05	0.21
Heptachlorepoxide	ng/L	18	66.7	0.07	MLE	0.04	0.13	15	66.7	0.14	MLE	0.06	0.31
Heptachlor	ng/L							15	20.0	0.04	MLE	0.01	0.15
OP - DDT	ng/L							15	20.0	0.09	HDL	0.05	0.17
PP - DDD	ng/L							15	53.3	0.18	MLE	0.08	0.41
PP - DDE	ng/L	18	38.9	0.03	MLE	0.01	0.08	15	73.3	0.15	MLE	0.06	0.38
PP - DDT	ng/L	18	27.8	0.07	MLE	0.03	0.15	15	46.7	0.47	HDL	0.18	1.21
Chlorobenzenes													
Hexachlorobenzene	ng/L	18	33.3	0.02	MLE	0.01	0.04	15	66.7	0.06	MLE	0.03	0.12
Hexachlorobutadiene	ng/L							15	20.0	0.01	HDL	0.01	0.03
Hexachloroethane	ng/L	18	22.2	0.01	MLE	0.01	0.01						
Pentachlorobenzene	ng/L	18	72.2	0.05	MLE	0.03	0.09	15	66.7	0.21	MLE	0.07	0.59
1,2,3 - Trichlorobenzene	ng/L	18	22.2	0.05	HDL	0.02	0.11	15	20.0	0.04	HDL	0.02	0.11
1,2,4 - Trichlorobenzene	ng/L	18	44.4	0.26	HDL	0.10	0.67	15	40.0	0.47	HDL	0.15	1.53
1,2,4,5 - Tetrachlorobenzene	ng/L	18	22.2	0.18	HDL	0.06	0.53						

TABLE 5.2: MIMICO CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
1.3.5 - Trichlorobenzene	ng/L							15	26.7	0.04	HDL	0.02	0.07
Polynuclear Aromatic Hydrocarbons													
Acenaphthene	ng/L							13	46.2	27.9	HDL	7.2	108.6
Anthracene	ng/L	16	25.0	2.8	HDL	1.3	5.8	13	61.5	52.4	HDL	14.1	194.7
Benzo (A) Anthracene	ng/L	16	56.3	14.8	HDL	5.8	38.0	13	100.0	70.2		29.4	167.8
Benzo (A) Pyrene	ng/L	16	62.5	22.4	MLE	7.5	67.0	13	100.0	139.8		52.5	372.3
Benzo (B) Fluoranthene {FA}	ng/L	16	68.8	71.5	HDL	23.5	217.3	13	100.0	255.4		102.1	638.8
Benzo (G-H-I) Perylene	ng/L	16	50.0	10.6	HDL	4.2	26.8	13	92.3	200.0	MLE	62.2	643.0
Chrysene	ng/L	16	81.3	30.0	MLE	11.7	77.1	13	100.0	165.9		63.9	430.6
Dibenzo (A-H) Anthracene	ng/L							13	76.9	57.0	MLE	15.5	210.5
Fluoranthene	ng/L	16	87.5	82.4	MLE	29.3	231.9	13	92.3	832.4	MLE	217.4	3187.9
Fluorene	ng/L							13	53.8	54.8	HDL	13.2	227.1
Indeno (1.2.3 - C,D) Pyrene	ng/L	16	43.8	9.2	HDL	3.6	23.2	13	92.3	216.2	MLE	63.8	733.3
1 - Methylnaphthalene	ng/L	16	25.0	9.2	HDL	3.2	26.7	13	30.8	203.6	HDL	34.8	1189.8
2 - Methylnaphthalene	ng/L	16	25.0	9.7	HDL	3.3	28.4	13	38.5	225.4	HDL	38.9	1306.0
Naphthalene	ng/L	16	50.0	6.9	HDL	2.8	16.8	13	53.8	155.1	HDL	30.0	802.3
Perylene	ng/L							13	76.9	76.7	MLE	18.6	316.4
Phenanthrene	ng/L	16	81.3	51.1	MLE	17.9	145.9	13	92.3	508.5	MLE	134.1	1928.1
Pyrene	ng/L	16	87.5	64.9	MLE	26.6	158.2	13	92.3	593.4	MLE	165.6	2126.0
Volatile Organics													

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Benzene	ng/L	16	25.0	63.4	MLE	18.2	220.1	15	33.3	46.1	MLE	17.4	122.3
Bromoform	ng/L	17	29.4	17.3	MLE	13.3	22.4						
Chlorodibromomethane	ng/L	17	76.5	34.1	MLE	24.8	46.9	15	73.3	26.0	MLE	21.4	31.5
Chloroform	ng/L	17	100.0	142.7		100.1	203.3	15	100.0	92.3		70.2	121.4
Dichlorobromomethane	ng/L	17	82.4	40.7	MLE	29.1	56.9	15	80.0	28.6	MLE	24.0	34.2
Dichloroethane	ng/L	17	52.9	31.9	MLE	20.6	49.4	15	93.3	58.5	MLE	39.2	87.1
1,1 - Dichloroethylene	ng/L							15	20.0	15.3	MLE	11.8	19.8
Ethylbenzene	ng/L							15	26.7	21.0	MLE	10.1	43.5
Styrene	ng/L							15	20.0	14.7	MLE	10.5	20.6
Tetrachloroethylene	ng/L	17	58.8	63.3	MLE	31.0	129.1	15	93.3	300.8	MLE	150.3	602.0
Toluene	ng/L							15	26.7	54.2	HDL	25.3	115.8
1,1,1 - Trichloroethane	ng/L	17	100.0	469.2		233.0	944.6	15	100.0	707.9		409.5	1223.5
Trichloroethylene	ng/L	17	82.4	90.7	MLE	50.9	161.6	15	100.0	223.2		131.8	377.9
O - Xylene	ng/L							15	33.3	74.8	HDL	33.0	169.5
P - Xylene	ng/L							15	33.3	85.3	MLE	25.5	286.1

NOTE:

- Blanks in the Mean column indicate below 20% of samples were above detection limits.

MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL

MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value

HDL - <W Values Were Replaced By Half The Detection Limit Value

GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.3: HUMBER RIVER : SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chemical Parameters													
Alkalinity	mg/L	22	100.0	201.4		185.2	219.2	25	100.0	177.5		162.2	194.3
Chemical Oxygen Demand	mg/L	22	100.0	22.8		18.0	28.9	26	100.0	34.5		28.0	42.5
Conductivity	uS/cm	22	100.0	900.6		772.6	1050.0	26	100.0	1255.3		961.4	1638.9
Chloride	mg/L	2	100.0	83.4		31.3	222.2	6	100.0	517.9		170.5	1572.9
Cyanide, Available	mg/L							26	30.8	0.002	MLE	0.001	0.004
pH	none	22	100.0	8.348		8.312	8.383	26	100.0	8.210		8.127	8.293
Phenols	ug/L	22	68.2	0.55	MLE	0.36	0.83	26	73.1	1.78	MLE	1.00	3.17
Suspended Solids	mg/L	21	100.0	16.86		11.77	24.16	26	100.0	149.68		83.04	269.80
Total Solids	mg/L	22	100.0	570.7		501.9	649.0	26	100.0	862.1		691.7	1074.5
Turbidity	FTU	22	100.0	10.8		7.1	16.5	25	100.0	95.1		51.6	175.1
Nutrients													
Ammonium	mg/L	22	77.3	0.10	MLE	0.07	0.13	26	76.9	0.16	MLE	0.11	0.24
Nitrates	mg/L	22	100.0	0.61		0.47	0.79	26	100.0	1.04		0.88	1.23
Nitrites	mg/L	22	100.0	0.023		0.018	0.030	26	100.0	0.049		0.036	0.067
Total Kjeldahl Nitrogen	mg/L	22	100.0	0.58		0.49	0.67	26	100.0	1.13		0.92	1.40
Phosphorus	mg/L	22	86.4	0.39	MLE	0.03	0.05	26	92.3	0.22	MLE	0.13	0.36

TABLE 5.3 HUMBER RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Bacteria													
Escherichia Coliform	#/dL	21	100.0	1015		683	1509	26	100.0	2685		1897	3801
Fecal Coliform	#/dL	21	100.0	1184		810	1730	26	100.0	3153		2208	4504
Fecal Streptococcus	#/dL	21	100.0	304		183	506	26	100.0	1971		1215	3196
Pseudomonas Aeruginosa	#/dL	21	100.0	26		16	43	26	100.0	71		43	118
Metals													
Aluminum	mg/L	21	100.0	0.684		.0356	1.356	26	100.0	2.603		1.483	4.569
Barium	mg/L	22	100.0	0.0698		0.0663	0.0734	26	100.0	0.0771		0.0681	0.0873
Beryllium	mg/L	22	36.4	0.00019	HDL	0.00009	0.00043	26	57.7	0.00041	HDL	0.00020	0.00087
Cadmium	mg/L	22	72.7	0.0012	MLE	0.0007	0.0020	26	61.5	0.0013	MLE	0.0007	0.0025
Chromium	mg/L	22	77.3	0.006	MLE	0.004	0.010	26	92.3	0.013	MLE	0.008	0.021
Copper	mg/L	21	100.0	0.0082		0.0064	0.0105	25	100.0	0.0170		0.0120	0.0240
Iron	mg/L	21	100.0	0.58		0.41	0.83	26	100.0	4.72		2.74	8.13
Lead	mg/L	22	86.4	0.020	MLE	0.015	0.028	26	88.5	0.027	MLE	0.018	0.039
Manganese	mg/L	21	100.0	0.0470		0.0350	0.0632	26	100.0	0.1679		0.1159	0.2433
Nickel	mg/L	22	81.8	0.007	MLE	0.004	0.011	26	84.6	0.012	MLE	0.007	0.019
Silver	mg/L	22	54.5	0.0022	MLE	0.0011	0.0044	26	57.7	0.0023	MLE	0.0012	0.0042
Zinc	mg/L	22	81.8	0.017	MLE	0.010	0.028	26	92.3	0.059	MLE	0.035	0.097

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L							26	46.2	54.5	MLE	44.4	66.9
Organochlorine Pesticides													
Total PCB's	ng/L	22	36.4	1.2	MLE	0.8	1.9	25	44.0	6.7	MLE	2.9	15.4
Alpha - BHC	ng/L	21	100.0	0.39		0.34	0.44	25	100.0	0.82		0.63	1.07
Gamma - BHC	ng/L	22	100.0	0.48		0.34	0.67	24	100.0	0.67		0.54	0.83
Alpha - Chlordane	ng/L	22	77.3	0.09	MLE	0.06	0.14	25	72.0	0.20	MLE	0.11	0.37
Gamma - Chlordane	ng/L	22	86.4	0.07	MLE	0.05	0.09	25	76.0	0.17	MLE	0.10	0.31
Dieldrin	ng/L	22	81.8	0.27	MLE	0.15	0.48	25	76.0	0.55	MLE	0.27	1.13
DMDT - Methoxychlor	ng/L	22	40.9	0.15	HDL	0.08	0.29	25	32.0	0.13	HDL	0.07	0.24
Thiodan Sulphate	ng/L	22	81.8	0.64	MLE	0.35	1.17	25	56.0	0.44	HDL	0.22	0.88
Thiodan I	ng/L	22	63.6	0.31	MLE	0.14	0.71	25	60.0	0.62	HDL	0.27	1.39
Thiodan II	ng/L							25	24.0	0.11	HDL	0.06	0.20
Heptachlorepoxide	ng/L	22	54.5	0.10	MLE	0.04	0.23	25	44.0	0.06	MLE	0.03	0.15
PP - DDD	ng/L	22	54.5	0.07	MLE	0.05	0.11	25	40.0	0.21	MLE	0.10	0.46
PP - DDE	ng/L	22	59.1	0.14	HDL	0.07	0.31	25	68.0	0.32	HDL	0.15	0.70
PP - DDT	ng/L	22	31.8	0.05	MLE	0.03	0.08	25	64.0	0.52	MLE	0.24	1.13

TABLE 5.3: HUMBER RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chlorobenzenes													
Hexachlorobenzene	ng/L	22	31.8	0.03	MLE	0.01	0.07	25	44.0	0.05	HDL	0.03	0.10
Hexachlorobutadiene	ng/L	22	27.3	0.03	MLE	0.01	0.08						
Hexachloroethane	ng/L	22	31.8	0.02	MLE	0.01	0.03						
Pentachlorobenzene	ng/L	22	59.1	0.05	MLE	0.03	0.10	25	60.0	0.14	HDL	0.07	0.29
1.2.3 - Trichlorobenzene	ng/L	22	22.7	0.05	HDL	0.03	0.12	24	20.8	0.04	HDL	0.02	0.08
1.2.4 - Trichlorobenzene	ng/L	22	40.9	0.30	HDL	0.13	0.71	25	40.0	1.40	HDL	0.50	3.92
1.2.4.5 - Tetrachlorobenzene	ng/L							25	20.0	0.05	HDL	0.03	0.11
1.3.5 - Trichlorobenzene	ng/L	22	31.8	0.21	HDL	0.09	0.50						
Polynuclear Aromatic Hydrocarbons													
Acenaphthene	ng/L							22	27.3	2.8	HDL	1.5	5.3
Anthracene	ng/L							22	45.5	8.3	HDL	3.9	17.9
Benzo (A) Anthracene	ng/L	20	50.0	5.5	MLE	2.3	13.3	22	90.9	65.7	MLE	29.1	148.4
Benzo (A) Pyrene	ng/L	20	50.0	6.8	MLE	2.7	16.8	22	90.9	95.4	MLE	40.1	227.0
Benzo (B) Fluoranthene {FA}	ng/L	19	84.2	23.0	MLE	10.9	48.2	22	95.5	198.0	MLE	88.9	440.5
Benzo (G-H-I) Perylene	ng/L	20	45.0	4.8	HDL	2.4	9.8	22	81.8	99.3	MLE	37.5	263.1
Chrysene	ng/L	20	80.0	13.3	MLE	6.4	27.6	22	95.5	117.5	MLE	53.6	257.6
Dibenzo (A-H) Anthracene	ng/L							22	27.3	2.1	HDL	1.2	3.7
Fluoranthene	ng/L	19	100.0	23.5		12.5	44.2	22	95.5	266.4	MLE	113.4	625.7
Fluorene	ng/L							22	45.5	14.0	HDL	6.0	32.5
Indeno (1.2.3 - C.D) Pyrene	ng/L	20	50.0	8.4	MLE	3.2	21.7	22	86.4	67.6	MLE	29.1	156.8
1 - Methylnaphthalene	ng/L							22	40.9	29.0	HDL	10.9	77.2

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
2 - Methylnaphthalene	ng/L	19	21.1	2.9	MLE	0.9	9.7	22	40.9	25.3	HDL	9.7	66.0
Naphthalene	ng/L	19	52.6	9.4	HDL	4.2	21.3	22	63.6	27.4	HDL	11.6	64.6
Perylene	ng/L							22	40.9	10.3	HDL	4.6	23.4
Phenanthrene	ng/L	20	85.0	8.9	MLE	4.7	17.0	22	90.9	181.2	MLE	72.6	452.4
Pyrene	ng/L	20	100.0	23.6		14.2	39.4	22	95.5	229.1	MLE	100.3	523.1
Volatile Organics													
Chloroform	ng/L	19	78.9	36.6	MLE	27.3	49.1	23	87.0	32.6	MLE	27.3	39.0
1,4 - Dichlorobenzene	ng/L	19	36.8	20.2	MLE	14.7	27.9	24	45.8	26.1	MLE	17.9	37.9
Tetrachloroethylene	ng/L	19	31.6	45.1	MLE	18.8	108.4	24	75.0	118.5	MLE	67.9	206.8
1,1,1 - Trichloroethane	ng/L	19	36.8	25.8	MLE	14.6	45.7	24	83.3	70.2	MLE	46.7	105.6
Trichloroethylene	ng/L	19	94.7	98.1	MLE	63.4	151.6	24	100.0	142.9		106.4	191.9

NOTE:

- Blanks in the Mean column indicate below 20% of samples were above detection limits.

MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL

MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value

HDL - < W Values Were Replaced By Half The Detection Limit Value

GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.4: DON RIVER : SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chemical Parameters													
Alkalinity	mg/L	24	100.0	206.1		193.2	219.9	21	100.0	155.1		141.0	170.6
Chemical Oxygen Demand	mg/L	24	100.0	27.8		23.5	32.8	21	100.0	33.3		25.6	43.4
Conductivity	uS/cm	24	100.0	1342.9		1124.3	1604.1	21	100.0	1100.7		858.0	1412.0
Chloride	mg/L	3	100.0	235.6		58.5	949.2	3	100.0	537.3		16.5	17469.9
Cyanide, Available	mg/L	24	25.0	0.002	MLE	0.001	0.005	20	30.0	0.002	MLE	0.001	0.005
pH	none	24	100.0	8.233		8.168	8.300	21	100.0	8.110		8.045	8.176
Phenols	ug/L	24	95.8	1.35	MLE	1.00	1.81	21	100.0	2.05		1.36	3.11
Suspended Solids	mg/L	24	100.0	8.65		7.26	10.30	20	100.0	115.23		79.34	167.36
Total Solids	mg/L	24	100.0	819.6		699.5	960.3	21	100.0	821.6		665.8	1013.8
Turbidity	FTU	23	100.0	7.3		5.6	9.6	20	100.0	98.1		62.1	155.1
Nutrients													
Ammonium	mg/L	25	100.0	0.90		0.60	1.35	21	85.7	0.29	MLE	0.17	0.48
Nitrates	mg/L	24	100.0	3.50		3.26	3.75	21	100.0	2.39		2.11	2.70
Nitrites	mg/L	25	100.0	0.214		0.153	0.298	21	100.0	0.166		0.121	0.227
Total Kjeldahl Nitrogen	mg/L	25	100.0	1.55		1.23	1.95	21	100.0	1.50		1.08	2.08
Phosphorus	mg/L	25	100.0	0.16		0.14	0.18	21	100.0	0.28		0.21	0.36
Bacteria													

TABLE 5.4: DON RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Escherichia Coliform	#/dL	22	90.9	3786	MLE	1052	13623	18	100.0	46437		14576	
Fecal Coliform	#/dL	22	90.9	16970	MLE	3909	73675	18	100.0	51157		16500	
Fecal Streptococcus	#/dL	22	95.5	264	MLE	108	643	18	100.0	7908		3037	20588
Pseudomonas Aeruginosa	#/dL	22	90.9	41	MLE	20	85	18	100.0	554		229	1340
Metals													
Aluminum	mg/L	23	100.0	0.140		0.115	0.172	20	100.0	3.252		1.957	5.404
Barium	mg/L	24	100.0	0.0659		0.0617	0.0704	21	100.0	0.0762		0.0675	0.0861
Beryllium	mg/L	24	58.3	0.00024	HDL	0.00012	0.00050	21	42.9	0.00012	HDL	0.00006	0.00025
Cadmium	mg/L	24	70.8	0.0012	MLE	0.0007	0.0020	21	71.4	0.0008	MLE	0.0005	0.0014
Chromium	mg/L	24	83.3	0.005	MLE	0.003	0.007	21	90.5	0.013	MLE	0.008	0.021
Copper	mg/L	24	100.0	0.0080		0.0066	0.0097	20	100.0	0.0215		0.0176	0.0262
Iron	mg/L	24	100.0	0.46		0.41	0.52	21	100.0	5.15		3.34	7.94
Lead	mg/L	24	83.3	0.017	MLE	0.005	0.022	21	90.5	0.031	MLE	0.022	0.044
Manganese	mg/L	24	100.0	0.0585		0.0471	0.0728	21	100.0	0.1883		0.1395	0.2540
Mercury	ug/L							21	38.1	0.02	MLE	0.02	0.04
Nickel	mg/L	24	87.5	0.006	MLE	0.004	0.009	21	85.7	0.014	MLE	0.008	0.025
Silver	mg/L	24	79.2	0.0045	MLE	0.0023	0.0087	21	61.9	0.0019	MLE	0.0010	0.0035
Zinc	mg/L	24	79.2	0.019	MLE	0.011	0.031	20	100.0	0.080		0.058	0.112
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L	24	41.7	90.8	MLE	52.4	157.4	18	72.2	93.7	MLE	67.7	129.7

TABLE 5.4: DON RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Organochlorine Pesticides													
Total PCB's	ng/L							19	84.2	11.2	MLE	6.4	19.6
Aldrin	ng/L							19	31.6	0.05	HDL	0.02	0.11
Alpha - BHC	ng/L	23	100.0	0.66		0.54	0.82	16	100.0	0.96		0.70	1.32
Beta - BHC	ng/L	24	20.8	0.03	HDL	0.02	0.07						
Gamma - BHC	ng/L	23	100.0	3.43		2.22	5.31	16	100.0	2.24		1.35	3.72
Alpha - Chlordane	ng/L	24	54.2	0.12	MLE	0.06	0.23	19	89.5	1.01	MLE	0.46	2.18
Gamma - Chlordane	ng/L	24	45.8	0.05	MLE	0.03	0.09	19	73.7	1.07	MLE	0.39	2.95
Dieldrin	ng/L	24	87.5	0.57	MLE	0.30	1.08	19	84.2	2.15	MLE	0.88	5.25
DMDT - Methoxychlor	ng/L	24	45.8	0.29	HDL	0.15	0.58	19	63.2	2.21	HDL	0.76	6.38
Thiodan Sulphate	ng/L	24	62.5	0.84	HDL	0.39	1.81	19	73.7	1.94	MLE	0.72	5.21
Thiodan I	ng/L	24	58.3	0.32	HDL	0.15	0.67	19	63.2	1.17	MVU	0.41	3.34
Heptachlorepoxide	ng/L	24	50.0	0.06	MLE	0.03	0.13	18	50.0	0.13	HDL	0.05	0.32
Heptachlor	ng/L							19	31.6	0.05	HDL	0.02	0.12
OP - DDT	ng/L							19	42.1	0.25	HDL	0.12	0.53
PP - DDD	ng/L	24	33.3	0.05	MLE	0.03	0.06	19	78.9	0.92	MLE	0.41	2.04
PP - DDE	ng/L	24	62.5	0.08	MLE	0.04	0.16	19	89.5	1.01	MLE	0.43	2.40
PP - DDT	ng/L	24	50.0	0.07	MLE	0.05	0.09	19	78.9	3.79	MLE	1.36	10.59
Chlorobenzenes													
Hexachlorobenzene	ng/L	24	37.5	0.04	MLE	0.02	0.09	19	63.2	0.28	MLE	0.10	0.77
Hexachlorobutadiene	ng/L	24	20.8	0.01	MLE	0.01	0.03	19	52.6	0.03	MLE	0.02	0.07

TABLE 5.4: DON RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Hexachloroethane	ng/L	24	25.0	0.02	MLE	0.01	0.05	19	31.6	0.04	MLE	0.01	0.11
Pentachlorobenzene	ng/L	24	50.0	0.08	MLE	0.04	0.18	19	84.2	0.33	MLE	0.16	0.67
1,2,3 - Trichlorobenzene	ng/L	24	25.0	0.08	HDL	0.04	0.18	19	36.8	0.09	HDL	0.04	0.22
1,2,3,4 - Tetrachlorobenzene	ng/L							19	21.1	0.02	HDL	0.01	0.04
1,2,4 - Trichlorobenzene	ng/L	24	79.2	1.11	MLE	0.49	2.49	19	78.9	1.27	MLE	0.50	3.25
1,2,4,5 - Tetrachlorobenzene	ng/L	24	29.2	0.83	HDL	0.27	2.54						
1,3,5 - Trichlorobenzene	ng/L	24	20.8	0.05	HDL	0.03	0.09	19	47.4	0.31	HDL	0.12	0.77
Polynuclear Aromatic Hydrocarbons													
Acenaphthene	ng/L	23	26.1	2.0	HDL	1.2	3.4	18	44.4	6.8	MLE	2.4	19.1
Anthracene	ng/L							18	66.7	25.1	MLE	9.2	68.9
Benzo (A) Anthracene	ng/L							18	100.0	59.5		30.6	115.8
Benzo (A) Pyrene	ng/L	23	34.8	5.0	MLE	2.0	13.0	18	94.4	135.7	MLE	60.9	302.3
Benzo (B) Fluoranthene {FA}	ng/L	23	65.2	16.7	MLE	7.1	39.0	18	100.0	237.1		106.5	527.8
Benzo (G-H-I) Perylene	ng/L	23	30.4	4.9	MLE	1.8	13.3	18	100.0	74.5		38.2	145.5
Chrysene	ng/L	23	60.9	9.1	MLE	4.1	20.2	18	100.0	121.6		61.4	241.0
Dibenzo (A-H) Anthracene	ng/L							18	50.0	9.1	HDL	3.9	21.0
Fluoranthene	ng/L	23	78.3	30.8	MLE	13.9	68.3	18	100.0	174.7		91.8	332.6
Fluorene	ng/L	23	30.4	4.4	HDL	2.2	8.7	18	61.1	6.2	MLE	2.7	14.2
Indeno (1,2,3 - C,D) Pyrene	ng/L	23	21.7	2.4	MLE	0.9	6.4	18	94.4	95.5	MLE	43.0	212.2
1 - Methylnaphthalene	ng/L	23	21.7	3.3	HDL	1.7	6.6	18	33.3	3.5	MLE	1.2	9.9
2 - Methylnaphthalene	ng/L	23	30.4	6.1	HDL	2.8	13.2	18	44.4	5.0	MLE	1.9	12.8
Naphthalene	ng/L	23	56.5	10.0	HDL	4.8	20.6	17	58.8	3.7	MLE	1.8	7.4

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Perylene	ng/L							18	66.7	31.3	HDL	12.1	80.8
Phenanthrene	ng/L	23	60.9	21.7	HDL	9.4	49.9	18	100.0	139.2		62.5	310.2
Pyrene	ng/L	23	91.3	27.9	MLE	15.6	49.9	18	100.0	157.4		84.4	293.7
Volatile Organics													
Benzene	ng/L	21	42.9	20.8	MLE	16.9	25.6	18	22.2	15.8	MLE	12.6	20.0
Bromoform	ng/L	23	52.2	22.9	MLE	18.2	29.0	18	22.2	19.0	MLE	8.8	40.9
Chlorodibromomethane	ng/L	23	91.3	42.2	MLE	31.0	57.6	18	66.7	48.7	MLE	28.4	83.4
Chloroform	ng/L	23	100.0	289.0		211.5	394.8	18	100.0	331.3		206.3	532.1
1,4 - Dichlorobenzene	ng/L	21	100.0	79.4		63.8	98.8	18	94.4	48.3	MLE	38.0	61.4
Dichlorobromomethane	ng/L	23	95.7	82.9	MLE	54.0	127.3	18	94.4	152.2	MLE	82.1	281.9
Ethylbenzene	ng/L	21	28.6	18.0	MLE	15.9	20.4						
Tetrachloroethylene	ng/L	23	95.7	61.3	MLE	47.5	79.0	18	94.4	79.6	MLE	56.1	112.9
Toluene	ng/L	17	58.8	36.6	MLE	23.1	58.0	13	38.5	19.6	MLE	15.0	25.8
1,1,1 - Trichloroethane	ng/L	23	52.2	21.6	MLE	18.0	25.8	18	83.3	42.9	MLE	30.7	60.0
Trichloroethylene	ng/L	23	65.2	31.9	MLE	23.5	43.4	17	88.2	69.2	MLE	45.7	104.7
O - Xylene	ng/L	21	47.6	23.1	MLE	17.9	29.8						
P - Xylene	ng/L	21	52.4	29.2	MLE	20.5	41.7						

NOTE:
- Blanks in the Mean column indicate below 20% of samples were above detection limits

MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL
MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value
HDL - < W Values Were Replaced By Half The Detection Limit Value
GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.5: HIGHLAND CREEK : SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chemical Parameters													
Alkalinity	mg/L	12	100.0	192.5		179.3	206.6	15	100.0	144.2		122.3	170.0
Chemical Oxygen Demand	mg/L	12	100.0	17.3		10.1	29.7	15	100.0	38.1		28.8	50.3
Conductivity	uU/cm	12	100.0	1133.7		945.33	1359.6	15	100.0	1202.2		777.3	1859.5
Chloride	mg/L	2	100.0	337.2				8	100.0	461.7		132.3	1610.7
Cyanide, Available	mg/L							15	20.0	0.002	MLE	0.000	0.005
pH	none	12	100.0	8.263		8.206	8.320	15	100.0	8.166		8.088	8.245
Phenols	ug/L	12	75.0	0.48	MLE	0.31	0.73	15	86.7	0.83	MLE	0.53	1.31
Suspended Solids	mg/L	12	100.0	6.30		3.65	10.87	15	100.0	146.48		57.85	370.89
Total Solids	mg/L	12	100.0	716.5		602.7	851.8	15	100.0	869.8		613.4	1233.4
Turbidity	FTU	12	100.0	4.3		2.1	8.7	14	100.0	124.5		39.6	391.2
Nutrients													
Ammonium	mg/L	12	75.0	0.08	MLE	0.06	0.10	15	86.7	0.11	MLE	0.07	0.19
Nitrates	mg/L	12	100.0	1.00	MLE	0.76	1.31	15	100.0	1.08		0.87	1.33
Nitrites	mg/L	12	91.7	0.021	MLE	0.013	0.034	15	100.0	0.045		0.027	0.076
Total Kjeldahl Nitrogen	mg/L	12	100.0	0.46		0.39	0.53	15	100.0	0.81		0.64	1.02
Phosphorus	mg/L	12	75.0	0.02	MLE	0.02	0.03	15	93.3	0.18	MLE	0.09	0.35

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Bacteria													
Escherichia Coliform	#/dL	11	100.0	399		237	673	10	100.0	6835		2781	16801
Fecal Coliform	#/dL	11	100.0	501		314	798	10	100.0	8603		3410	21707
Fecal Streptococcus	#/dL	11	100.0	207		110	390	10	100.0	4135		1455	11750
Pseudomonas Aeruginosa	#/dL	11	100.0	49		23	108	10	100.0	892		213	3725
Metals													
Aluminum	mg/L	12	91.7	0.132	MLE	0.053	0.326	15	100.0	4.772		1.617	14.083
Barium	mg/L	12	100.0	0.0724		0.0652	0.0805	15	100.0	0.0701		0.0593	0.0828
Beryllium	mg/L	12	33.3	0.00015	HDL	0.00005	0.00045	15	46.7	0.00026	HDL	0.00009	0.00070
Cadmium	mg/L	12	25.0	0.0004	HDL	0.0002	0.0009	15	66.7	0.0013	MLE	0.0006	0.0029
Chromium	mg/L	12	83.3	0.011	MLE	0.005	0.027	15	93.3	0.011	MLE	0.006	0.019
Copper	mg/L	11	100.0	0.0059		0.0037	0.0095	15	100.0	0.0158		0.0118	0.0212
Iron	mg/L	11	100.0	0.23		0.15	0.35	15	100.0	5.36		2.18	13.18
Lead	mg/L	12	58.3	0.013	MLE	0.006	0.027	15	100.0	0.032		0.021	0.049
Manganese	mg/L	11	100.0	0.0244		0.0151	0.0394	15	100.0	0.1561		0.0786	0.3101
Mercury	ug/L							15	26.7	0.02	MLE	0.01	0.04
Nickel	mg/L	12	83.3	0.005	MLE	0.003	0.010	15	73.3	0.013	MLE	0.005	0.029
Silver	mg/L	12	41.7	0.0012	MLE	0.0005	0.0029	15	20.0	0.0010	HDL	0.0005	0.0020
Zinc	mg/L	12	33.3	0.005	MLE	0.002	0.014	15	93.3	0.055	MLE	0.026	0.115

TABLE 5.5: HIGHLAND CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Metalloids													
Arsenic	mg/L							15	40.0	0.002	MLE	0.001	0.005
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L	12	25.0	40.6	MLE	27.6	59.7	15	40.0	57.7	MLE	35.9	92.7
Organochlorine Pesticides													
Alpha - BHC	ng/L	12	83.3	0.77	MLE	0.26	2.30	13	61.5	1.13	MVU	0.25	5.06
Gamma - BHC	ng/L	12	83.3	2.04	MLE	0.56	7.49	13	61.5	1.79	MVU	0.36	8.92
Alpha - Chlordane	ng/L	12	83.3	0.06	MLE	0.04	0.10	12	66.7	0.25	MLE	0.09	0.75
Gamma - Chlordane	ng/L	12	58.3	0.04	MLE	0.02	0.08	12	75.0	0.15	MLE	0.07	0.37
Dieldrin	ng/L	12	83.3	0.30	MLE	0.14	0.66	13	92.3	0.86	MLE	0.40	1.84
DMDT - Methoxychlor	ng/L	12	41.7	0.13	MLE	0.05	0.37	13	61.5	0.83	MLE	0.24	2.85
Thiodan Sulphate	ng/L	12	75.0	0.73	MLE	0.26	2.05	13	61.5	1.68	HDL	0.49	5.77
Thiodan I	ng/L	12	75.0	0.91	MLE	0.27	3.06	13	76.9	1.39	HDL	0.42	4.61
Thiodan II	ng/L	12	25.0	0.08	HDL	0.04	0.17						
Heptachlorepoxide	ng/L	11	45.5	0.05	MLE	0.02	0.14	13	61.5	0.07	MLE	0.03	0.15
PP - DDD	ng/L							13	23.1	0.04	MLE	0.02	0.07
PP - DDE	ng/L							13	61.5	0.13	MLE	0.04	0.38
PP - DDT	ng/L	12	25.0	0.05	MLE	0.02	0.11	12	58.3	0.17	MLE	0.07	0.40

TABLE 5.5: HIGHLAND CREEK CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chlorobenzenes													
Pentachlorobenzene	ng/L	12	50.0	0.04	MLE	0.02	0.11	13	53.8	0.10	HDL	0.04	0.29
1,2,3 - Trichlorobenzene	ng/L	12	25.0	0.04	HDL	0.01	0.09						
1,2,4 - Trichlorobenzene	ng/L	12	41.7	0.22	HDL	0.07	0.71						
1,2,4,5 - Tetrachlorobenzene	ng/L							13	23.1	0.07	HDL	0.02	0.22
1,3,5 - Trichlorobenzene	ng/L	12	33.3	0.13	HDL	0.04	0.39						
Polynuclear Aromatic Hydrocarbons													
Anthracene	ng/L							13	23.1	5.0	HDL	1.8	13.8
Benzo (A) Anthracene	ng/L							13	69.2	76.4	HDL	20.6	282.4
Benzo (A) Pyrene	ng/L							13	84.6	40.7	MLE	14.8	112.0
Benzo (B) Fluoranthene {FA}	ng/L							13	92.3	67.4	MLE	28.0	162.6
Benzo (G-H-I) Perylene	ng/L							13	76.9	45.9	MLE	15.0	140.6
Chrysene	ng/L	12	25.0	1.5	MLE	0.5	4.6	13	76.9	64.3	MLE	18.8	219.8
Dibenzo (A-H) Anthracene	ng/L							13	23.1	2.3	HDL	1.1	5.1
Fluoranthene	ng/L	12	75.0	5.6	MLE	2.6	12.2	13	100.0	66.6		36.4	121.6
Fluorene	ng/L							13	30.8	5.7	MLE	1.3	24.4
Indeno (1.2.3 - C,D) Pyrene	ng/L							13	38.5	11.8	HDL	3.8	36.9
1 - Methylnaphthalene	ng/L	12	33.3	1.8	MLE	0.7	4.9						
Naphthalene	ng/L	12	50.0	8.3	MLE	2.4	28.2						
Perylene	ng/L							13	46.2	7.9	HDL	2.9	21.1
Phenanthrene	ng/L	12	33.3	1.4	MLE	0.6	3.2	13	69.2	95.5	HDL	25.4	359 3
Pyrene	ng/L	12	75.0	7.1	MLE	3.2	15.9	13	100.0	61.1		34.1	110 5

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Volatile Organics													
Bromoform	ng/L							13	30.8	17.8	MLE	12.9	24.4
Chloroform	ng/L	12	83.3	43.7	MLE	30.1	63.5	13	100.0	36.4		29.6	44.8
Tetrachloroethylene	ng/L							13	61.5	29.4	MLE	20.6	42.1
Toluene	ng/L							13	23.1	16.9	MLE	14.1	20.1
1,1,1 - Trichloroethane	ng/L	12	33.3	18.3	MLE	14.1	23.7	12	66.7	36.4	MLE	22.2	59.6
Trichloroethylene	ng/L							13	23.1	16.3	MLE	12.6	21.0
P - Xylene	ng/L							14	21.4	17.6	MLE	15.9	19.6

NOTE:

- Blanks in the Mean column indicate below 20% of samples were above detection limits.

MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL

MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value

HDL - < W Values Were Replaced By Half The Detection Limit Value

GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.6: ROUGE RIVER : SUMMARY OF CONTAMINANT CONCENTRATION MEANS BY SAMPLE WEATHER CONDITIONS - INCLUDING 95% CONFIDENCE INTERVALS AND FREQUENCY OF DETECTION

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS					WET WEATHER SAMPLE CONDITIONS				
		Frequency		Mean		Confidence Interval	Frequency		Mean		Confidence Interval
		N	% > MDL			LL UL	N	% > MDL			LL UL
Chemical Parameters											
Alkalinity	mg/L	11	100.0	164.8		145.0 187.3	17	100.0	163.0		149.8 177.4
Chemical Oxygen Demand	mg/L	11	100.0	22.6		11.9 42.9	17	100.0	24.4		18.2 32.8
Conductivity	uU/cm	11	100.0	783.5		628.3 976.9	17	100.0	816.2		645.7 1031.9
Chloride	mg/L	3	100.0	214.0		34.6 1324.6	9	100.0	151.7		73.6 312.5
pH	none	11	100.0	8.261		8.218 8.304	15	100.0	8.225		8.142 8.308
Phenols	ug/L	11	72.7	0.45	MLE	0.27 0.73	17	52.9	0.46	MLE	0.26 0.82
Suspended Solids	mg/L	11	100.0	8.86		5.93 13.25	17	100.0	124.06		60.30 255.21
Total Solids	mg/L	11	100.0	509.2		408.1 635.4	17	100.0	653.7		534.4 799.7
Turbidity	FTU	11	100.0	3.7		2.6 5.2	16	100.0	67.6		30.5 149.9
Nutrients											
Ammonium	mg/L	11	63.6	0.18	MLE	0.07 0.46	17	70.6	0.20	MLE	0.10 0.40
Nitrates	mg/L	11	90.9	0.46	MLE	0.17 1.26	17	100.0	1.08		0.71 1.63
Nitrites	mg/L	11	90.9	0.013	MLE	0.007 0.026	17	100.0	0.031		0.020 0.046
Total Kjeldahl Nitrogen	mg/L	11	100.0	0.63		0.43 0.91	17	100.0	1.08		0.80 1.46
Phosphorus	mg/L	11	63.6	0.04	MLE	0.02 0.09	17	100.0	0.20		0.11 0.38

TABLE 5.6: ROUGE RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Bacteria													
Escherichia Coliform	#/dL	9	100.0	314		108	912	10	100.0	1060		489	2297
Fecal Coliform	#/dL	9	100.0	391		129	1187	10	100.0	1171		567	2420
Fecal Streptococcus	#/dL	9	100.0	457		108	1936	10	100.0	1444		771	2705
Pseudomonas Aeruginosa	#/dL	9	100.0	15		6	36	10	100.0	71		24	206
Metals													
Aluminum	mg/L	11	100.0	0.142		0.106	0.190	17	100.0	2.441		1.183	5.038
Barium	mg/L	11	100.0	0.0573		0.0520	0.0631	17	100.0	0.0712		0.0593	0.0855
Beryllium	mg/L	11	27.3	0.00012	HDL	0.00004	0.00039	17	58.8	0.00040	HDL	0.00015	0.00102
Cadmium	mg/L	11	36.4	0.0007	HDL	0.0003	0.0017	17	41.2	0.0015	MLE	0.0005	0.0046
Chromium	mg/L	11	100.0	0.016		0.011	0.022	17	100.0	0.014		0.010	0.018
Copper	mg/L	9	100.0	0.0052		0.0032	0.0084	17	100.0	0.0086		0.0065	0.0115
Iron	mg/L	11	100.0	0.28		0.20	0.37	17	100.0	3.58		1.80	7.15
Lead	mg/L	11	63.6	0.017	MLE	0.007	0.039	17	88.2	0.022	MLE	0.015	0.032
Manganese	mg/L	11	100.0	0.0313		0.0250	0.0393	17	100.0	0.1404		0.0840	0.2346
Nickel	mg/L	11	81.8	0.004	MLE	0.002	0.007	17	76.5	0.008	MLE	0.004	0.017
Silver	mg/L	11	54.5	0.0018	MLE	0.0007	0.0046	17	41.2	0.0017	MLE	0.0007	0.0043
Zinc	mg/L	11	36.4	0.003	MLE	0.001	0.006	17	47.1	0.014	HDL	0.006	0.032

TABLE 5.6: ROUGE RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Metalloids													
Arsenic	mg/L							17	23.5	0.002	MLE	0.001	0.007
Pesticides and Chlorophenols													
Pentachlorophenol	ng/L							17	29.4	55.1	MLE	29.9	101.6
Organochlorine Pesticides													
Alpha - BHC	ng/L	11	72.7	0.81	HDL	0.21	3.14	16	75.0	0.17	GM	0.06	0.55
Gamma - BHC	ng/L	11	72.7	0.65	MLE	0.16	2.60	16	75.0	0.92	MLE	0.30	2.82
Alpha - Chlordane	ng/L							16	43.8	0.09	MLE	0.03	0.24
Gamma - Chlordane	ng/L							16	37.5	0.13	MLE	0.04	0.41
Dieldrin	ng/L	11	72.7	0.10	MLE	0.05	0.22	16	81.3	0.20	MLE	0.10	0.40
DMDT - Methoxychlor	ng/L							16	43.8	0.22	HDL	0.10	0.49
Thiodan Sulphate	ng/L	11	63.6	3.73	MVU	0.73	18.97	16	43.8	2.71	HDL	0.75	9.78
Thiodan I	ng/L	11	45.5	0.34	HDL	0.09	1.35	16	43.8	0.34	HDL	0.12	0.94
Thiodan II	ng/L							16	25.0	0.18	HDL	0.08	0.43
Heptachlorepoxide	ng/L	11	36.4	0.02	MLE	0.01	0.03	16	25.0	0.03	MLE	0.01	0.07
PP - DDD	ng/L							16	31.3	0.13	MLE	0.05	0.36
PP - DDE	ng/L	11	63.6	0.05	MLE	0.02	0.13	16	62.5	0.10	MLE	0.04	0.26
PP - DDT	ng/L							16	31.3	0.30	MLE	0.08	1.06

TABLE 5.6: ROUGE RIVER CONTAMINANT CONCENTRATIONS (CONTINUED)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Chlorobenzenes													
Hexachlorobenzene	ng/L	11	27.3	0.02	MLE	0.01	0.06						
Hexachloroethane	ng/L	11	36.4	0.01	MLE	0.01	0.01						
Pentachlorobenzene	ng/L							16	25.0	0.02	MLE	0.01	0.07
1.2.4 - Trichlorobenzene	ng/L	11	27.3	0.05	HDL	0.02	0.13						
1.2.4.5 - Tetrachlorobenzene	ng/L	11	27.3	0.03	HDL	0.01	0.09						
Polynuclear Aromatic Hydrocarbons													
Benzo (A) Anthracene	ng/L	10	30.0	3.4	MLE	0.7	15.9	15	53.3	34.9	HDL	10.9	111.2
Benzo (A) Pyrene	ng/L							15	60.0	50.3	HDL	15.5	163.3
Benzo (B) Fluoranthene {FA}	ng/L	10	60.0	7.3	MLE	2.3	23.0	15	73.3	175.3	HDL	50.1	613.4
Benzo (G-H-I) Perylene	ng/L							15	53.3	33.3	HDL	10.4	106.3
Chrysene	ng/L	10	50.0	5.0	MLE	1.5	16.6	15	60.0	83.5	HDL	23.6	294.5
Fluoranthene	ng/L	10	80.0	8.5	MLE	3.6	20.1	15	86.7	154.3	MLE	55.1	432.1
Indeno (1.2.3 - C.D) Pyrene	ng/L							15	40.0	25.2	HDL	7.7	82.3
Naphthalene	ng/L	10	40.0	1.5	MLE	0.7	3.1	15	20.0	2.5	HDL	1.2	5.4
Perylene	ng/L							15	33.3	7.6	HDL	2.9	20.2
Phenanthrene	ng/L	10	40.0	2.8	MLE	0.9	8.9	15	60.0	107.4	HDL	29.5	391.3
Pyrene	ng/L	10	80.0	10.1	MLE	4.0	25.3	15	93.3	85.4	MLE	39.6	184.3

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS						WET WEATHER SAMPLE CONDITIONS					
		Frequency		Mean		Confidence Interval		Frequency		Mean		Confidence Interval	
		N	% > MDL			LL	UL	N	% > MDL			LL	UL
Volatile Organics													
Chloroform	ng/L	10	50.0	20.2	MLE	17.0	23.9	12	50.0	20.5	MLE	17.5	24.0
Tetrachloroethylene	ng/L							11	36.4	18.7	MLE	14.9	23.6
1,1,1 - Trichloroethane	ng/L							12	41.7	20.6	MLE	13.0	32.5
P - Xylene	ng/L	9	22.2	13.3	HDL	9.7	18.1						

NOTE:

- Blanks in the Mean column indicate below 20% of samples were above detection limits.

MLE - Maximum Likelihood Estimator Used If: i) At Least 3 Values Are > MDL ii) At Least 20% Of The Data Is > MDL

MVU - Maximum Variance Unbiased Estimate Used ie. Mean Estimate > Maximum Value

HDL - < W Values Were Replaced By Half The Detection Limit Value

GM - Geometric Mean Used ie. Both Original Mean Estimate And MVU Mean > Maximum Value

TABLE 5.7: ETOBICOKE CREEK CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chemical Parameters									
Phenols	g/d	10	54.60	33.22	23	668.10	188.91	436.78	118.35
Suspended Solids	kg/d	10	72.85	5.77	23	37078.7	12405.7	23125.7	7728.1
Total Solids	kg/d	10	24523.0	2412.9	23	328771.1	63714.1	214054.6	39701.2
Nutrients									
Ammonium	kg/d	10	3.61	2.17	23	299.29	148.50	187.80	92.51
Nitrates	kg/d	9	11.95	1.64	23	298.18	51.23	190.26	31.92
Nitrites	kg/d	10	0.47	0.07	23	32.84	8.17	20.64	5.09
Total Kjeldahl Nitrogen	kg/d	10	15.64	2.08	23	835.04	245.32	526.09	152.83
Phosphorus	kg/d	10	0.52	0.04	23	71.83	19.86	44.94	12.37
Bacteria									
Escherichia Coliform	gct/d	10	0.20	0.08	22	9.99	5.80	6.30	3.61
Fecal Coliform	gct/d	10	0.29	0.01	22	16.64	12.12	10.47	7.55
Fecal Streptococcus	gct/d	10	0.09	0.04	22	6.11	2.02	3.84	1.26
Pseudomonas Aeruginosa	gct/d	10	0.02	0.01	22	0.84	0.54	0.53	0.34
Metals									
Aluminum	kg/d	10	2.50	0.42	23	903.01	310.69	563.47	193.55
Barium	kg/d	10	1.35	0.05	23	16.21	1.50	10.60	0.94
Beryllium	kg/d	10	0.004	0.002	23	0.06	0.01	0.04	0.01

ETOBICOKE CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Cadmium	kg/d	10	0.02	0.01	23	0.36	0.07	0.24	0.05
Chromium	kg/d	10	0.25	0.05	23	3.60	0.66	2.34	0.41
Copper	kg/d	10	0.24	0.05	22	8.23	1.60	5.22	1.00
Iron	kg/d	10	4.19	0.54	22	1698.2	559.2	1059.5	348.36
Lead	kg/d	10	0.52	0.08	23	12.07	2.15	7.72	1.34
Manganese	kg/d	10	0.57	0.28	22	65.14	14.66	40.80	9.13
Nickel	kg/d	10	0.19	0.03	23	4.15	1.01	2.66	0.63
Silver	kg/d	10	0.05	0.02	23	0.28	0.08	0.19	0.05
Zinc	kg/d	10	0.21	0.04	23	30.40	7.78	19.02	4.85
Organochlorine Pesticides									
Total PCB's	mg/d	10	46.44	27.84	23	2614.3	1062.5	1646.1	661.9
Alpha - BHC	mg/d	9	18.89	2.43	22	340.92	71.76	219.50	44.71
Gamma - BHC	mg/d	10	13.16	0.83	22	287.30	48.67	183.94	30.32
Alpha - Chlordane	mg/d	10	1.33	0.57	23	35.24	13.96	22.45	8.70
Gamma - Chlordane	mg/d	10	0.84	0.27	23	29.08	10.75	18.43	6.70
Dieldrin	mg/d	10	4.76	0.74	23	68.07	22.60	44.20	14.08
Thiodan Sulphate	mg/d	10	10.17	2.61	23	116.70	46.19	76.53	28.79
Thiodan I	mg/d	10	2.08	0.92	23	57.56	38.86	36.64	24.21
Heptachlorepoxide	mg/d	10	0.86	0.21	23	10.88	4.54	7.10	2.83
PP - DDD	mg/d	10	1.01	0.23	23	23.20	8.09	14.83	5.03
PP - DDE	mg/d	10	1.64	1.28	23	34.94	15.50	22.38	9.67
PP - DDT	mg/d	10	0.78		23	101.29	54.25	63.39	33.80

ETOBICOKE CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides									
Pentachlorobenzene	mg/d	10	0.82	0.33	23	30.59	10.76	19.36	6.70
Polynuclear Aromatic Hydrocarbons									
Benzo (A) Anthracene	mg/d	8	15.53		20	36862.6	18228.7	22969.4	11355.6
Benzo (A) Pyrene	mg/d	8	36.86	21.34	20	59417.9	28854.9	37028.4	17975.2
Benzo (B) Fluoranthene	mg/d	8	139.79	113.48	20	86137.8	40361.7	53712.3	25143.4
Benzo (G-H-I) Perylene	mg/d	8	15.53		20	39745.0	15989.3	24765.0	9960.5
Chrysene	mg/d	8	44.61	29.11	20	80317.3	39645.5	50050.5	24697.2
Fluoranthene	mg/d	8	160.96	67.04	20	152717.6	62760.7	95196.2	39096.9
Indeno (1.2.3 - C.D) Pyrene	mg/d	8	15.53		20	38687.7	16290.3	24106.4	10148.0
Naphthalene	mg/d	8	87.00	41.00	20	6332.6	3127.8	3977.7	1948.5
Phenanthrene	mg/d	8	41.47	25.83	20	112612.5	54370.9	70167.7	33870.4
Pyrene	mg/d	8	278.09	104.05	20	128043.8	53092.6	79869.8	33074.1
Volatile Organics									
Chloroform	mg/d	10	5170.5	1219.0	22	27129.1	2811.9	18849.6	1810.9
Tetrachloroethylene	mg/d	10	1115.0	266.4	22	59146.0	35160.1	37265.5	21903.4
1.1.1 - Trichloroethane	mg/d	10	2338.7	650.2	22	63904.4	20232.6	40691.1	12606.3
Trichloroethylene	mg/d	10	348.35	38.05	22	6711.60	1278.67	4312.3	796.7

NOTE: RMSE = Root Mean Square Error
gct/d = gega (10^{12}) counts/day

TABLE 5.8: MIMICO CREEK CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chemical Parameters									
Phenols	g/d	10	11.90	1.96	21	358.59	122.06	186.67	61.54
Suspended Solids	kg/d	10	351.99	272.00	21	12595.2	3404.5	6523.9	1721.5
Total Solids	kg/d	10	12982.6	1253.9	20	163048.1	42679.2	88632.1	21524.0
Nutrients									
Ammonium	kg/d	10	1.40	0.37	21	8.92	2.68	5.19	1.36
Nitrates	kg/d	10	10.40	1.32	20	134.53	12.94	72.97	6.55
Nitrites	kg/d	10	0.50	0.05	21	12.22	4.68	6.41	2.36
Total Kjeldahl Nitrogen	kg/d	10	13.35	3.33	21	169.00	25.60	91.81	13.01
Phosphorus	kg/d	10	1.94	0.97	21	27.90	5.82	15.02	2.97
Bacteria									
Escherichia Coliform	gct/d	10	0.54	0.27	20	2.97	0.65	1.76	0.35
Fecal Coliform	gct/d	10	0.58	0.29	20	7.47	3.82	4.05	1.93
Fecal Streptococcus	gct/d	10	0.71	0.51	20	3.16	0.74	1.94	0.45
Pseudomonas Aeruginosa	gct/d	10	0.01	0.005	20	0.26	0.13	0.14	0.07
Metals									
Aluminum	kg/d	10	5.76	3.61	20	178.23	71.25	92.70	35.96
Barium	kg/d	10	0.79	0.04	21	7.09	0.76	3.97	0.38
Beryllium	kg/d	10	0.002	0.001	21	0.02	0.01	0.01	0.005

MIMICO CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Cadmium	kg/d	10	0.04	0.03	20	0.18	0.05	0.11	0.03
Chromium	kg/d	10	0.14	0.03	21	1.37	0.18	0.76	0.09
Copper	kg/d	10	0.21	0.06	21	2.60	0.43	1.41	0.22
Iron	kg/d	10	11.13	7.59	19	557.47	148.18	286.55	74.80
Lead	kg/d	10	0.40	0.07	20	5.71	2.36	3.08	1.19
Manganese	kg/d	10	0.97	0.58	20	22.60	3.86	11.87	1.97
Nickel	kg/d	10	0.10	0.02	21	1.43	0.18	0.77	0.09
Silver	kg/d	10	0.03	0.01	21	0.47	0.22	0.25	0.11
Zinc	kg/d	10	0.27	0.09	21	13.57	3.96	6.97	2.00
Organochlorine Pesticides									
Total PCB's	mg/d	10	58.53	46.58	20	770.74	176.74	417.56	91.95
Alpha - BHC	mg/d	10	11.05	1.13	19	181.78	59.96	97.12	30.23
Gamma - BHC	mg/d	10	8.33	0.90	18	122.64	21.02	65.95	10.60
Alpha - Chlordane	mg/d	10	3.19	1.20	20	47.16	17.99	25.36	9.09
Gamma - Chlordane	mg/d	10	1.78	0.67	20	46.13	18.79	24.14	9.48
Dieldrin	mg/d	10	5.24	1.43	20	41.47	6.57	23.50	3.38
Thiodan Sulphate	mg/d	10	11.25	3.81	20	49.18	10.21	30.37	5.48
Thiodan I	mg/d	10	7.60	4.01	20	65.13	29.26	36.60	14.89
Heptachlorepoxide	mg/d	10	1.36	0.37	20	14.14	4.50	7.80	2.27
PP - DDD	mg/d	10	58.53	46.58	20	770.74	176.56	417.56	91.95
PP - DDE	mg/d	10	0.64	0.13	20	22.46	7.13	11.64	3.59
PP - DDT	mg/d	10	3.02	1.93	20	45.95	15.24	24.66	7.74

MIMICO CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides									
Pentachlorobenzene	mg/d	10	1.63	1.10	20	12.99	3.40	7.36	1.80
Polynuclear Aromatic Hydrocarbons									
Benzo (A) Anthracene	mg/d	9	262.07	156.25	17	9327.2	4934.4	4831.9	2488.7
Benzo (A) Pyrene	mg/d	9	254.54	203.73	17	17899.4	10071.4	9149.5	5078.1
Benzo (B) Fluoranthene	mg/d	9	627.95	446.62	17	36529.5	19682.8	18726.3	9924.8
Benzo (G-H-I) Perylene	mg/d	9	229.34	198.25	17	17111.3	9508.3	8739.7	4794.3
Chrysene	mg/d	9	328.85	222.07	17	21579.5	12415.5	11041.5	6259.8
Fluoranthene	mg/d	9	800.75	568.19	17	49662.2	28648.1	25432.3	14444.5
Indeno (1,2,3 - C,D) Pyrene	mg/d	9	195.84	172.18	17	18264.3	12316.8	9304.3	6209.6
Naphthalene	mg/d	9	33.79	16.35	17	21201.0	18375.2	10704.4	9263.1
Phenanthrene	mg/d	9	513.40	378.14	17	32193.9	17930.3	16483.8	9040.8
Pyrene	mg/d	9	781.00	499.15	17	38730.2	21344.2	19911.6	10762.6
Volatile Organics									
Chloroform	mg/d	10	2426.2	268.8	20	8732.2	1295.8	5605.1	666.7
Tetrachloroethylene	mg/d	10	3029.6	1314.2	20	74819.0	15863.5	39219.4	8023.4
1,1,1 - Trichloroethane	mg/d	10	684.53	167.16	20	31195.8	5691.0	16065.6	2870.1
Trichloroethylene	mg/d	10	913.38	602.30	20	45181.2	10110.2	23229.2	5105.4

NOTE: RMSE = Root Mean Square Error
gct/d = gega (10^{12}) counts/day

TABLE 5.9: HUMBER RIVER CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chemical Parameters									
Phenols	g/d	7	68.62	16.68	36	819.80	154.60	626.87	114.97
Suspended Solids	kg/d	7	1623.1	480.4	35	384497.4	132628.5	286163.6	98565.5
Total Solids	kg/d	7	58440.2	3495.2	36	795134.0	97039.8	605928.5	72122.6
Nutrients									
Ammonium	kg/d	7	7.67	2.41	36	93.66	19.59	71.57	14.57
Nitrates	kg/d	7	39.47	5.79	36	1068.5	98.6	804.19	73.31
Nitrites	kg/d	7	3.00	0.81	36	44.34	14.93	33.72	11.10
Total Kjeldahl Nitrogen	kg/d	7	60.41	7.35	36	1415.7	241.8	1067.6	179.7
Phosphorus	kg/d	7	3.61	0.93	36	455.66	139.27	339.56	103.50
Bacteria									
Escherichia Coliform	gct/d	7	0.97	0.24	35	20.48	2.96	15.47	2.20
Fecal Coliform	gct/d	7	1.18	0.29	35	22.31	3.09	16.88	2.30
Fecal Streptococcus	gct/d	7	0.24	0.07	35	15.41	3.48	11.52	2.59
Pseudomonas Aeruginosa	gct/d	7	0.02	0.01	35	0.37	0.12	0.28	0.09
Metals									
Aluminum	kg/d	7	30.86	10.67	35	7899.0	2992.0	5878.2	2223.6
Barium	kg/d	7	8.37	0.35	36	93.69	15.79	71.77	11.73
Beryllium	kg/d	7	0.01	0.005	36	0.61	0.21	0.46	0.16

HUMBER RIVER CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Cadmium	kg/d	7	0.10	0.04	36	0.62	0.20	0.49	0.15
Chromium	kg/d	7	0.89	0.28	36	17.13	5.30	12.96	3.94
Copper	kg/d	7	1.09	0.20	34	22.87	5.31	17.27	3.94
Iron	kg/d	7	59.98	17.70	35	14190.7	5303.7	10561.5	3941.6
Lead	kg/d	7	2.39	0.50	36	37.90	9.95	28.78	7.40
Manganese	kg/d	7	4.96	1.25	35	331.10	97.52	247.34	72.48
Nickel	kg/d	7	0.81	0.17	36	21.92	7.33	16.50	5.44
Silver	kg/d	7	0.23	0.08	36	1.21	0.45	0.95	0.33
Zinc	kg/d	7	1.18	0.32	36	66.54	16.68	49.76	12.39
Organochlorine Pesticides									
Total PCB's	mg/d	7	135.82	56.67	35	6160.0	3153.4	4612.8	2343.5
Alpha - BHC	mg/d	7	50.12	4.89	34	985.94	280.78	745.59	208.67
Gamma - BHC	mg/d	7	109.16	68.71	34	679.21	70.23	532.81	55.09
Alpha - Chlordane	mg/d	7	10.47	2.43	35	215.13	51.54	162.57	38.30
Gamma - Chlordane	mg/d	7	10.65	1.95	35	215.39	61.25	162.81	45.52
Dieldrin	mg/d	7	38.32	8.68	35	227.94	53.90	179.24	40.12
Thiodan Sulphate	mg/d	7	68.01	19.52	35	355.59	81.41	281.73	60.71
Thiodan I	mg/d	7	29.62	5.60	35	178.08	63.06	139.95	46.88
Heptachlorepoxide	mg/d	7	12.46	5.66	35	50.80	14.54	40.95	10.90
PP - DDD	mg/d	7	11.91	3.11	35	207.07	49.80	156.94	37.02
PP - DDE	mg/d	7	10.69	3.43	35	400.90	161.91	300.68	120.33
PP - DDT	mg/d	7	6.61	2.09	35	738.49	270.79	550.52	201.25

HUMBER RIVER CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides									
Pentachlorobenzene	mg/d	7	4.45	1.82	35	117.60	52.47	88.54	39.00
Polynuclear Aromatic Hydrocarbons									
Benzo (A) Anthracene	mg/d	5	672.78	322.96	32	16534.6	4328.6	12460.8	3217.9
Benzo (A) Pyrene	mg/d	5	553.10	323.67	32	21879.4	6845.4	16402.2	5087.9
Benzo (B) Fluoranthene	mg/d	5	2963.5	964.7	31	59905.7	28967.4	45281.2	21529.1
Benzo (G-H-I) Perylene	mg/d	5	832.55	510.17	32	17998.1	4522.9	13589.4	3363.8
Chrysene	mg/d	5	1729.9	811.9	32	27111.1	6546.9	20592.4	4869.9
Fluoranthene	mg/d	5	2896.7	630.0	31	60049.0	15898.0	45370.5	11816.0
Indeno (1,2,3 - C,D) Pyrene	mg/d	5	661.07	397.05	32	20515.4	5599.1	15416.2	4162.4
Naphthalene	mg/d	5	960.58	436.20	31	10925.7	6226.1	8366.4	4628.4
Phenanthrene	mg/d	5	704.99	312.99	32	35167.2	9117.7	26316.2	6776.5
Pyrene	mg/d	5	3172.3	772.5	32	49604.3	11995.3	37679.2	8916.7
Volatile Organics									
Chloroform	mg/d	6	3601.9	547.3	33	23602.1	3646.0	18465.4	2713.2
Tetrachloroethylene	mg/d	6	1228.5	0.1	33	77673.2	25544.7	58039.8	18984.1
1,1,1 - Trichloroethane	mg/d	6	6275.8	2047.3	33	89089.2	12151.4	67820.2	9045.8
Trichloroethylene	mg/d	6	1228.5	0.1	33	63644.5	20227.3	47614.2	15032.3

NOTE: RMSE = Root Mean Square Error
gct/d = gega (10^{12}) counts/day

TABLE 5.10: DON RIVER CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chemical Parameters									
Phenols	g/d	7	156.41	40.29	30	830.66	156.80	639.07	112.83
Suspended Solids	kg/d	7	1091.9	68.5	30	67636.6	11735.9	48727.7	8401.1
Total Solids	kg/d	7	92702.7	4985.6	30	411354.8	33192.8	320808.8	23803.1
Nutrients									
Ammonium	kg/d	7	120.35	49.49	31	143.69	31.06	137.06	26.31
Nitrates	kg/d	6	573.03	26.76	31	1340.8	80.6	1122.6	58.2
Nitrites	kg/d	7	38.93	19.05	31	69.92	11.38	61.11	9.78
Total Kjeldahl Nitrogen	kg/d	7	228.67	47.47	31	695.67	133.60	562.97	96.59
Phosphorus	kg/d	7	33.36	4.86	31	134.67	12.53	105.88	9.08
Bacteria									
Escherichia Coliform	gct/d	6	6.97	4.69	28	58.46	15.22	43.83	10.98
Fecal Coliform	gct/d	6	42.10	27.27	28	66.14	17.36	59.31	14.65
Fecal Streptococcus	gct/d	6	1.12	1.08	28	13.11	2.76	9.70	2.00
Pseudomonas Aeruginosa	gct/d	6	0.11	0.06	28	1.44	0.51	1.06	0.36
Metals									
Aluminum	kg/d	7	19.58	2.27	28	1162.6	324.5	837.83	232.30
Barium	kg/d	7	10.10	0.44	30	39.69	2.11	31.28	1.51
Beryllium	kg/d	7	0.03	0.01	30	0.058	0.023	0.05	0.02

DON RIVER CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Cadmium	kg/d	7	0.10	0.05	30	0.54	0.09	0.41	0.07
Chromium	kg/d	7	1.10	0.34	30	5.20	0.82	4.03	0.59
Copper	kg/d	7	1.33	0.34	29	9.70	0.95	7.32	0.69
Iron	kg/d	7	62.47	3.93	30	2368.1	468.8	1712.9	335.6
Lead	kg/d	7	2.18	0.49	30	17.00	2.09	12.79	1.51
Manganese	kg/d	7	5.54	0.68	30	84.06	9.91	61.75	7.10
Nickel	kg/d	7	0.67	0.23	30	5.94	0.94	4.44	0.67
Silver	kg/d	7	0.34	0.14	30	1.65	0.71	1.28	0.51
Zinc	kg/d	7	1.46	0.37	29	37.17	5.13	27.02	3.68
Organochlorine Pesticides									
Total PCB's	mg/d	7	99.48	19.56	29	3934.4	724.3	2844.7	518.5
Alpha - BHC	mg/d	6	85.72	14.53	27	558.27	72.33	423.99	51.94
Gamma - BHC	mg/d	6	701.67	85.16	27	913.73	140.60	853.48	103.52
Alpha - Chlordane	mg/d	7	16.74	5.43	29	409.84	136.13	298.14	97.46
Gamma - Chlordane	mg/d	7	7.89	2.73	29	364.47	162.43	263.15	116.27
Dieldrin	mg/d	7	50.87	21.16	29	477.74	86.58	356.45	62.27
Thiodan Sulphate	mg/d	7	124.45	48.95	29	408.50	97.46	327.79	71.14
Thiodan I	mg/d	7	60.94	35.46	29	259.86	46.60	203.22	34.85
Heptachlorepoxide	mg/d	7	5.40	1.71	28	50.83	12.53	37.92	8.98
PP - DDD	mg/d	7	8.57	3.13	29	412.70	146.89	297.86	105.16
PP - DDE	mg/d	7	9.92	4.16	29	459.46	201.10	331.72	143.96
PP - DDT	mg/d	7	8.77	2.50	29	1114.7	431.6	800.46	308.98

DON RIVER CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides									
Pentachlorobenzene	mg/d	7	2.07	0.86	29	100.63	17.79	72.63	12.74
Polynuclear Aromatic Hydrocarbons									
Benzo (A) Anthracene	mg/d	6	269.29	189.59	28	13805.2	2500.2	9958.9	1790.6
Benzo (A) Pyrene	mg/d	6	261.27	181.57	28	24648.3	5171.2	17718.7	3702.1
Benzo (B) Fluoranthene	mg/d	6	1145.7	653.9	28	41876.2	11576.0	30302.5	8288.7
Benzo (G-H-I) Perylene	mg/d	6	79.41	0.00	28	20336.2	4409.1	14580.2	3156.2
Chrysene	mg/d	6	510.57	380.63	28	27390.8	5710.9	19752.7	4089.6
Fluoranthene	mg/d	6	1518.3	676.9	28	48590.5	10144.4	35214.8	7264.4
Indeno (1,2,3 - C,D) Pyrene	mg/d	6	79.41	0.00	28	22176.3	5413.7	15897.4	3875.4
Naphthalene	mg/d	6	590.74	282.64	27	2009.8	447.3	1606.6	330.1
Phenanthrene	mg/d	6	530.20	379.74	28	26935.6	5627.8	19432.5	4030.1
Pyrene	mg/d	6	2265.0	612.2	28	45492.9	10714.4	33209.5	7671.8
Volatile Organics									
Chloroform	mg/d	7	65153.5	31226.2	28	190669.5	40502.0	155003.7	30320.6
Tetrachloroethylene	mg/d	7	2205.0	401.9	28	24279.6	3784.5	18007.0	2711.5
1,1,1 - Trichloroethane	mg/d	7	7541.4	3532.8	27	41809.0	8952.8	32071.7	6487.0
Trichloroethylene	mg/d	7	9005.4	1742.2	28	36970.9	4900.4	29024.4	3542.7

NOTE RMSE = Root Mean Square Error
gct/d = gega (10^9) counts/day

TABLE 5.11: HIGHLAND CREEK CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chemical Parameters									
Phenols	g/d	5	24.31	7.13	12	88.26	17.13	62.47	10.62
Suspended Solids	kg/d	5	262.71	92.14	12	56653.9	9115.5	33913.0	5439.6
Total Solids	kg/d	5	24418.0	3707.1	12	138405.1	23644.8	92437.6	14188.5
Nutrients									
Ammonium	kg/d	5	2.79	0.45	12	22.11	6.27	14.32	3.75
Nitrates	kg/d	5	31.60	4.22	12	201.50	16.97	132.99	10.27
Nitrites	kg/d	5	0.58	0.25	12	4.58	2.31	2.97	1.39
Total Kjeldahl Nitrogen	kg/d	5	17.32	1.25	12	181.61	17.97	115.36	10.74
Phosphorus	kg/d	5	0.56	0.09	12	76.84	16.34	46.08	9.75
Bacteria									
Escherichia Coliform	gct/d	4	0.36	0.25	7	5.01	2.50	3.14	1.50
Fecal Coliform	gct/d	4	0.41	0.28	7	5.78	2.90	3.61	1.73
Fecal Streptococcus	gct/d	4	0.10	0.05	7	5.69	3.32	3.44	1.98
Pseudomonas Aeruginosa	gct/d	4	0.02	0.01	7	0.17	0.11	0.11	0.07
Metals									
Aluminum	kg/d	5	1.27	0.70	12	1358.9	193.7	811.40	115.57
Barium	kg/d	5	2.67	0.10	12	16.27	1.78	10.784	1.06
Beryllium	kg/d	5	0.01	0.01	12	0.08	0.04	0.054	0.02

HIGHLAND CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Cadmium	kg/d	5	0.03	0.02	12	0.33	0.06	0.209	0.03
Chromium	kg/d	5	0.23	0.03	12	3.75	0.41	2.332	0.24
Copper	kg/d	5	0.13	0.03	12	4.73	0.76	2.878	0.45
Iron	kg/d	5	5.43	1.32	12	2196.9	291.4	1313.1	173.9
Lead	kg/d	5	0.53	0.17	12	9.38	2.31	5.815	1.38
Manganese	kg/d	5	0.78	0.38	12	62.00	6.74	37.312	4.02
Nickel	kg/d	5	0.21	0.08	12	2.76	0.43	1.728	0.26
Silver	kg/d	5	0.05	0.01	12	0.05	0.00	0.052	0.01
Zinc	kg/d	5	0.10	0.06	12	13.85	2.75	8.30	1.64
Organochlorine Pesticides									
Total PCB's	mg/d								
Alpha - BHC	mg/d	5	14.41	5.37	10	171.77	86.52	108.31	51.68
Gamma - BHC	mg/d	5	12.62	4.75	10	64.66	32.76	43.67	19.64
Alpha - Chlordane	mg/d	5	1.05	0.36	9	63.53	24.06	38.33	14.36
Gamma - Chlordane	mg/d	5	1.06	0.46	10	300.60	252.46	179.80	150.65
Dieldrin	mg/d	5	6.93	1.88	10	245.15	79.83	149.01	47.65
Thiodan Sulphate	mg/d	5	7.92	3.99	10	411.85	96.66	248.96	57.71
Thiodan I	mg/d	5	17.99	9.08	10	168.93	58.62	108.06	35.17
Heptachlorepoxide	mg/d	5	1.01	0.30	10	18.23	9.78	11.29	5.84
PP - DDD	mg/d	5	0.90	0.00	10	16.52	4.61	10.22	2.75
PP - DDE	mg/d	5	0.32	0.15	10	18.14	8.21	10.95	4.90
PP - DDT	mg/d	5	0.90	0.00	9	47.84	20.79	28.91	12.41

HIGHLAND CREEK CONTAMINANT MASS LOADINGS SUMMARY (cont'd)

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides									
Pentachlorobenzene	mg/d	5	1.06	0.43	10	125.11	97.30	75.08	58.06
Polynuclear Aromatic Hydrocarbons									
Benzo (A) Anthracene	mg/d	5	21.77	3.76	10	16203.8	4323.7	9678.1	2580.1
Benzo (A) Pyrene	mg/d	5	29.47	11.32	10	7981.9	1947.1	4774.9	1161.9
Benzo (B) Fluoranthene	mg/d	5	49.36	19.07	10	16925.8	4586.9	10120.1	2737.1
Benzo (G-H-I) Perylene	mg/d	5	17.91		10	6320.8	1770.1	3779.0	1056.3
Chrysene	mg/d	5	57.07	25.62	10	4038.9	2944.6	2433.1	1757.2
Fluoranthene	mg/d	5	101.73	40.91	10	23184.8	5193.5	13876.1	3099.2
Indeno (1,2,3 - C,D) Pyrene	mg/d	5	17.91		10	1005.3	836.0	607.11	498.87
Naphthalene	mg/d	5	96.99	30.41	10	195.53	125.57	155.79	75.93
Phenanthrene	mg/d	5	44.62	17.31	10	13895.5	5149.8	8310.1	3073.1
Pyrene	mg/d	5	108.91	31.84	10	20879.3	4647.9	12503.2	2773.6
Volatile Organics									
Chloroform	mg/d	5	2442.5	472.5	11	7402.3	1186.1	5402.1	733.0
Tetrachloroethylene	mg/d	5	558.97	145.70	11	36546.4	22867.4	22033.8	13645.8
1,1,1 - Trichloroethane	mg/d	5	358.28		10	2943.1	740.8	1900.7	442.1
Trichloroethylene	mg/d	5	358.28		10	7570.4	1231.2	4662.0	734.7

NOTE: RMSE = Root Mean Square Error
gct/d = gega (10^{12}) counts/day

TABLE 5.12: ROUGE RIVER CONTAMINANT MASS LOADINGS SUMMARY

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS				ANNUAL LOADINGS	
		N	MEAN	RMSE	N		MEAN	RMSE	MEAN	RMSE
Chemical Parameters										
Phenols	g/d	5	33.12	7.78	11 3	i) ii)	89.67 371.58	32.11 255.98	93.94	27.69
Suspended Solids	kg/d	5	479.90	70.6	11 3	i) ii)	9130.7 1606084.0	1681.5 642005.6	107429.4	40361.8
Total Solids	kg/d	5	26420.4	1810.2	11 3	i) ii)	139497.8 2151142.0	25180.5 529111.4	239033.5	37629.3
Nutrients										
Ammonium	kg/d	5	3.98	1.03	11 3	i) ii)	63.22 315.77	31.39 177.72	65.01	24.64
Nitrates	kg/d	5	13.88	4.88	11 3	i) ii)	237.64 1576.8	35.96 568.2	268.60	43.69
Nitrites	kg/d	5	0.60	0.12	11 3	i) ii)	8.78 44.22	3.55 32.64	9.07	3.22
Total Kjeldahl Nitrogen	kg/d	5	31.71	3.79	11 3	i) ii)	247.30 3229.0	55.23 514.3	383.43	50.38
Phosphorus	kg/d	5	4.55	3.44	11 3	i) ii)	25.26 1681.2	5.66 622.3	124.40	39.32
Bacteria										
Escherichia Coliform	gct/d	3	0.68	0.41	8		1.31	0.36	1.16	0.29
Fecal Coliform	gct/d	3	0.81	0.54	8		1.77	0.38	1.54	0.32
Fecal Streptococcus	gct/d	3	0.74	0.59	8		4.48	1.26	3.59	0.97
Pseudomonas Aeruginosa	gct/d	3	0.02	0.01	8		0.04	0.01	0.04	0.01

(cont'd) **ROUGE RIVER CONTAMINANT MASS LOADINGS SUMMARY**

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS				ANNUAL LOADINGS	
		N	MEAN	RMSE	N		MEAN	RMSE	MEAN	RMSE
Metals										
Aluminum	kg/d	5	6.97	1.25	11	i)	184.23	38.58	2028.9	754.6
					3	ii)	30209.0	12000.5		
Barium	kg/d	5	3.29	0.13	11	i)	11.80	0.40	28.34	5.61
					3	ii)	307.10	89.20		
Beryllium	kg/d	5	0.006	0.006	11	i)	0.03	0.02	0.16	0.08
					3	ii)	2.11	1.26		
Cadmium	kg/d	5	0.02	0.01	11	i)	0.02	0.00	0.48	0.29
					3	ii)	7.35	4.63		
Chromium	kg/d	5	0.74	0.14	11	i)	1.71	0.29	5.27	1.39
					3	ii)	62.02	21.91		
Copper	kg/d	4	0.21	0.03	11	i)	1.40	0.15	4.24	1.11
					3	ii)	51.06	17.63		
Iron	kg/d	5	13.54	1.63	11	i)	303.57	67.71	3049.0	1153.0
					3	ii)	45089.3	18331.6		
Lead	kg/d	5	1.35	0.59	11	i)	4.64	1.24	7.76	1.69
					3	ii)	66.69	22.89		
Manganese	kg/d	5	1.60	0.23	11	i)	16.08	2.05	96.04	29.67
					3	ii)	1343.2	471.6		
Nickel	kg/d	5	0.11	0.03	11	i)	0.97	0.49	4.12	1.61
					3	ii)	54.44	25.05		
Silver	kg/d	5	0.09	0.03	11	i)	0.14	0.05	0.15	0.03
					3	ii)	0.45	0.00		
Zinc	kg/d	5	0.18	0.11	11	i)	0.56	0.34	7.09	2.55
					3	ii)	105.93	40.40		

(cont'd) **ROUGE RIVER CONTAMINANT MASS LOADINGS SUMMARY**

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS				ANNUAL LOADINGS	
		N	MEAN	RMSE	N		MEAN	RMSE	MEAN	RMSE
Organochlorine Pesticides										
Total PCB's	mg/d	5	31.10		11 3	i) ii)	125.58 905.06	27.41	152.11	19.17
Alpha - BHC	mg/d	5	24.49	13.02	11 3	i) ii)	91.80 1514.4	31.11 488.3	165.20	37.74
Gamma - BHC	mg/d	5	10.86	5.60	11 3	i) ii)	63.72 1040.2	32.30 584.4	112.52	43.14
Alpha - Chlordane	mg/d	5	2.28	1.72	11 3	i) ii)	4.29 360.35	1.64 136.74	26.19	8.68
Gamma - Chlordane	mg/d	5	2.28	1.72	11 3	i) ii)	13.14 301.79	8.58 121.50	28.70	9.72
Dieldrin	mg/d	5	5.73	1.59	11 3	i) ii)	35.13 612.36	14.23 440.89	64.41	29.44
Thiodan Sulphate	mg/d	5	166.90	64.50	11 3	i) ii)	210.00 550.09	125.68 685.47	221.13	99.09
Thiodan I	mg/d	5	1.74	0.92	11 3	i) ii)	64.88 214.51	42.14 263.31	59.28	33.80
Heptachlorepoxide	mg/d	5	0.93	0.21	11 3	i) ii)	3.33 203.69	1.00 138.25	15.35	8.72
PP - DDD	mg/d	5	4.48	3.05	11 3	i) ii)	5.24 591.69	0.25 136.68	41.91	8.62
PP - DDE	mg/d	5	2.61	1.11	11 3	i) ii)	6.10 85.52	2.57 71.59	10.26	4.85
PP - DDT	mg/d	5	3.93	2.48	11 3	i) ii)	9.51 652.61	4.85 101.08	48.60	7.22

(cont'd) **ROUGE RIVER CONTAMINANT MASS LOADINGS SUMMARY**

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS				ANNUAL LOADINGS	
		N	MEAN	RMSE	N		MEAN	RMSE	MEAN	RMSE
Chlorobenzene Pesticides										
Pentachlorobenzene	mg/d	5	0.31	0.00	11 3	i) ii)	2.45 96.05	0.81 64.74	7.82	4.11
Polynuclear Aromatic Hydrocarbons										
Benzo (A) Anthracene	mg/d	5	123.09	101.94	11 3	i) ii)	1881.67 113292.5	528.00 16881.0	8464.9	1123.5
Benzo (A) Pyrene	mg/d	5	80.76	51.81	11 3	i) ii)	2867.6 100798.2	1025.5 64961.0	8359.3	4144.8
Benzo (B) Fluoranthene	mg/d	5	240.53	106.45	11 3	i) ii)	7562.1 261822.8	2853.8 172851.6	21862.8	110440.2
Benzo (G-H-I) Perylene	mg/d	5	31.10		11 3	i) ii)	2428.3 73561.7	1123.9 54996.6	6328.6	3544.3
Chrysene	mg/d	5	157.86	92.48	11 3	i) ii)	4031.7 95661.6	1941.6 95843.7	8869.0	6174.2
Fluoranthene	mg/d	5	1808.1	1254.4	11 3	i) ii)	8690.0 224942.9	3078.5 101097.5	20643.8	6714.7
Indeno (1,2,3 - C,D) Pyrene	mg/d	5	31.10		11 3	i) ii)	1698.0 69750.4	1002.2 50577.0	5578.3	3254.7
Naphthalene	mg/d	5	86.93	35.44	11 3	i) ii)	179.44 6050.3	83.53 6458.0	526.38	410.10
Phenanthrene	mg/d	5	136.88	83.64	11 3	i) ii)	3106.6 134597.9	1363.3 77448.2	10663.8	4959.5
Pyrene	mg/d	5	1526.6	939.2	11 3	i) ii)	8143.9 196298.7	2546.4 85034.0	18394.8	5637.1

PARAMETER	Units	DRY WEATHER SAMPLE CONDITIONS			WET WEATHER SAMPLE CONDITIONS			ANNUAL LOADINGS	
		N	MEAN	RMSE	N	MEAN	RMSE	MEAN	RMSE
Volatile Organics									
Chloroform	mg/d	5	1183.7	293.0	8 2	i) 2993.7 ii) 42087.5	524.3 1731.2	5020.1	388.8
Tetrachloroethylene	mg/d	5	621.9	0.06	8 2	i) 4552.6 ii) 41082.7	1707.2 13697.1	5193.9	1472.0
1,1,1 - Trichloroethane	mg/d								
Trichloroethylene	mg/d	5	621.9	0.06	7 2	i) 3720.9 ii) 20803.5	823.5 8870.7	4057.8	801.6

NOTE: RMSE = Root Mean Square Error
gct/d = gega (10^{12}) counts/day

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